Cornell Engineering
Applied and Engineering Physics

AEP

Newsletter
Fall 2019

AEP
MESSAGE FROM THE DIRECTOR

DEAR FRIENDS OF AEP,

2019 has been an exciting year for our School, and many of our most significant accomplishments are highlighted in this newsletter. A high point was the recognition of Harold Craighead, now Professor Emeritus, by the students and scientists he inspired. In July, we welcomed Assistant Professor Peter McMahon whose interest in the physics of computation keeps AEP's research on the leading edge. Our community remains dynamic, with faculty leading Cornell's research centers in new directions, and innovating our teaching methods. We are also delighted to bring you news of our students, present and past, and include photos of two of my favorite events: commencement and the annual alumni breakfast (during Reunion Weekend). It is always wonderful to connect with AEP alums. Feel free to reach out to me at aep_director@cornell.edu. I so enjoy hearing from you.

With warm wishes,

Lois Pollack
Professor and Director
Applied and Engineering Physics

AEP's Alumni Newsletter

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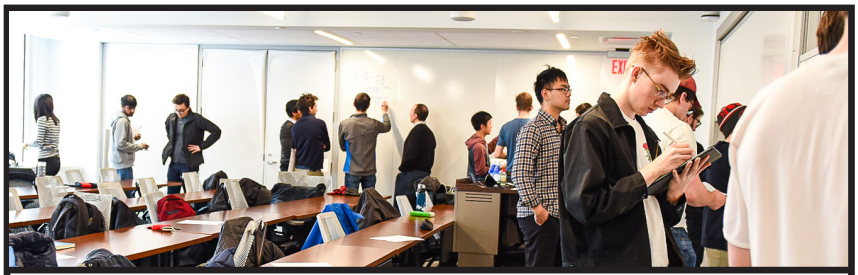
INSIDE THIS ISSUE

ON THE COVER

Sayo Studio artist Nicolle Rager Fuller's impression of a hybrid photonic-electronic computer. Pulses of light are used to represent bits or spins, and interactions between the pulses are mediated by an electronic feedback loop. Professor McMahon's lab is exploring ways in which photonics can be used to construct novel computers.



GIVING TO AEP

THIS YEAR'S GIVING PRIORITY:

A CLASSROOM EQUIPPED FOR ACTIVE LEARNING AND FLIPPED CLASSROOM TEACHING.

TO MAKE A GIFT:

CONTACT: PAIGE ONSTAD
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VISIT: HTTPS://WWW.AEP.CORNELL.EDU/AEP AND CLICK "GIVE"

Images from a Flipped Classroom in session: AEP 3620.

NEW TO AEP

AEP is pleased to announce a new staff hire.

Jessica Troy-Smith joined the AEP finance team as Account Representative in April 2019. Jessica most recently worked as Finance Specialist as part of the College of Engineering, Cornell Tech, Computing and Information Science, and, before then, the banking industry. Jessica is a graduate of Tompkins Cortland Community College.

ON THE WEB

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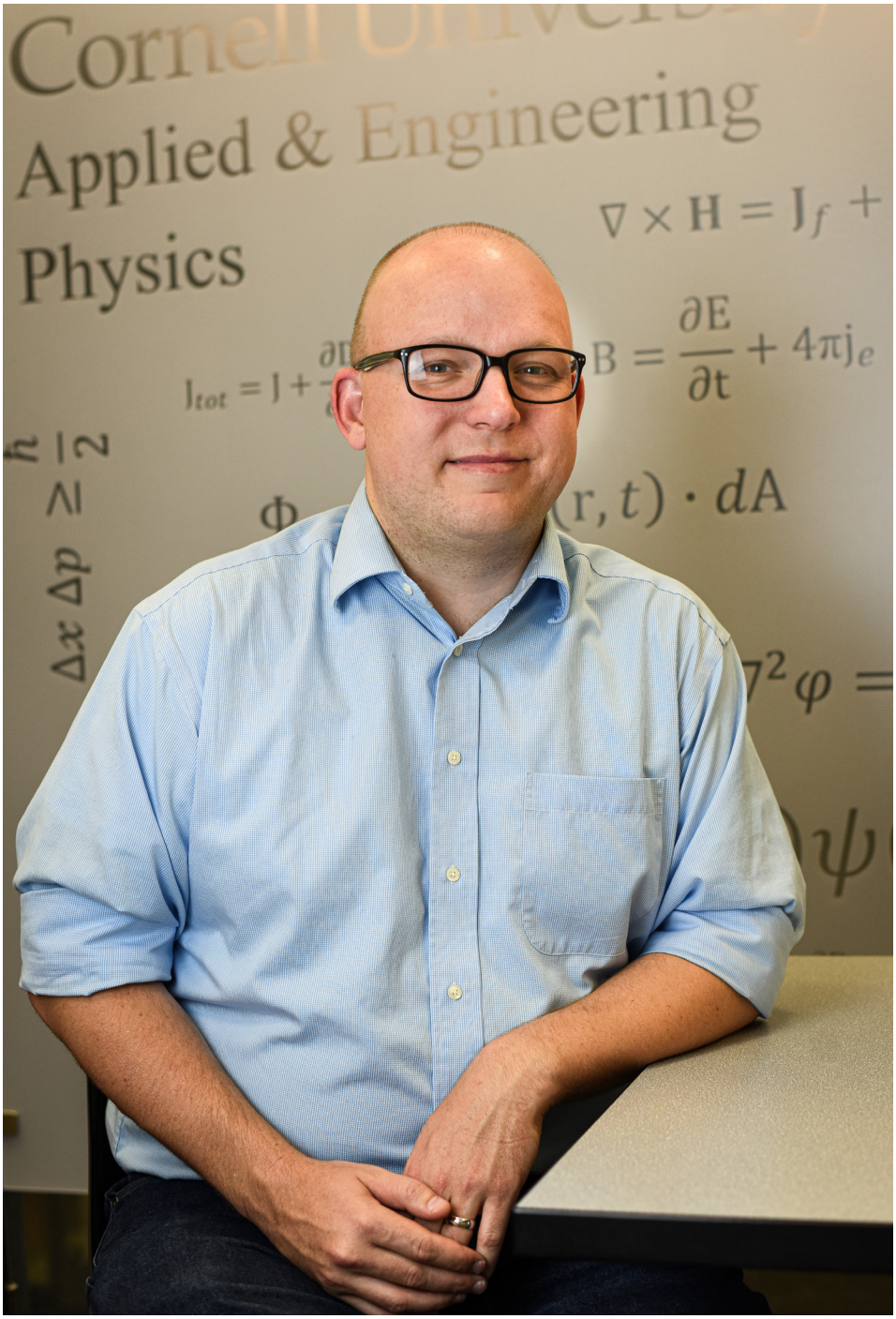
AEP WELCOMES PETER MCMAHON

By Christopher Dawson



Peter McMahon joined the faculty of the School of Applied and Engineering Physics (AEP) at Cornell as an assistant professor in the summer of 2019.

McMahon's research focuses on the physics of computation. Specifically, he explores how physical systems can be engineered to perform computation in new ways that provide advantages over existing computational systems. He and his lab have an emphasis on quantum computation, while also exploring photonic computers (computers using light) and neuromorphic computers (computers inspired by the way human brains work).

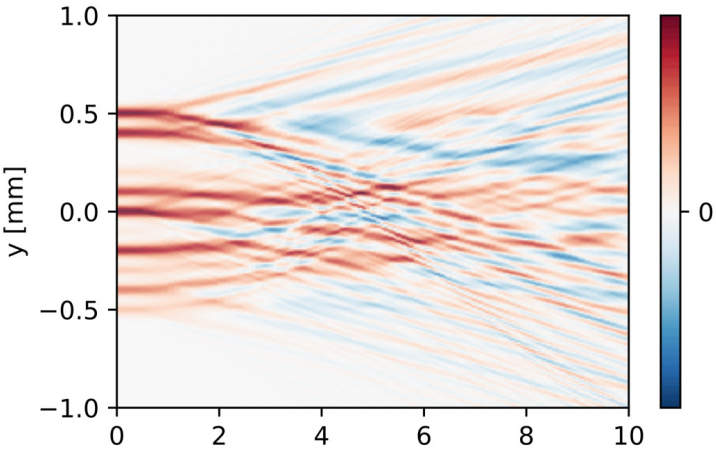
MCMAHON'S RESEARCH FOCUSES ON THE PHYSICS OF COMPUTATION

McMahon grew up in South Africa, not far from the port city of Durban. In high school, McMahon enjoyed studying math and physics, and spent a lot of his time writing computer programs. He even ran a small contracting business writing database software for companies.

Reflecting back on that time now, more than 15 years later, McMahon sees some parallels to starting his lab at Cornell. "Running a research lab is a lot like having a small business," he says. "Only, a university research lab is a start-up that will never have revenue, and for which you perpetually need to raise funding."

McMahon received his B.S. in electrical and computer engineering from the University of Cape Town. He continued at Cape Town and earned a master's in electrical engineering and another concurrently in computer science. He then moved to Palo Alto and earned an M.S. and a Ph.D. in electrical engineering from Stanford University.

Laid out like this, McMahon's path seems straightforward. In reality, things



Above: Simulation of the propagation of light through a two-dimension chip in which one has full control over the refractive index as a function of space in the y-z plane.

were actually rather more serendipitous. "In my senior year at Cape Town I had the opportunity to visit the National Center for Supercomputing Applications at the University of Illinois for the summer. There I worked on accelerating scientific-computing applications using special-purpose chips called FPGAs," says McMahon.

After his undergraduate studies and largely as a result of his work in Illinois, McMahon was invited to do a Master's thesis project involving the same special-purpose chips for a planned radio telescope in South Africa. The telescope's design team sent him to UC Berkeley for a year, where he worked on custom processing boards that are used specifically to collect and process data from radio telescopes. "At first glance this experience might seem completely unrelated to what I do now, but the electronics for controlling and recording the output of quantum computers in many cases uses very similar technology," says McMahon.

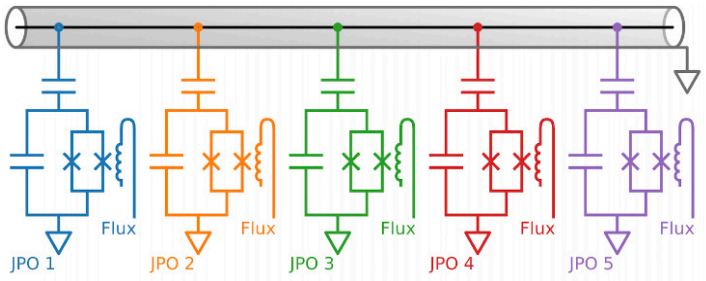
He then went off to earn his doctorate at Stanford. At Stanford, he conducted his research in the lab of Professor Yoshihisa Yamamoto. McMahon's focus was on quantum information processing using optically controlled spins in semiconductors. He then spent five more years at Stanford as a postdoctoral fellow in Hideo Mabuchi's lab in the Department of Applied Physics, working on a new project in optical computing in collaboration with Yamamoto and his group. McMahon's postdoctoral work has led to a resurgence of interest in photonic computers for solving optimization problems.

In 2019, McMahon joined the faculty at Cornell. "Cornell is a wonderful place for me to be," says McMahon. "Much of the work I do is most definitely applied physics, so it is great to be at a place where people appreciate this niche that straddles physics and engineering."

McMahon's lab at Cornell focuses on the broad theme of learning more about how physical systems can be used to compute. He explores how we might build quantum computers and for what we might best use them. In addition, he also delves into photonic and neuromorphic computing.

"THE WORK I DO IS MOST DEFINITELY APPLIED."
— PETER MCMAHON

McMahon moved to Ithaca with his wife, Ying Yang, who is also at Cornell, and who has a joint appointment between the Sloan Program in Health Administration and the McGovern Center for Venture Development.



Above: A proposed scheme to couple quantum oscillators in a superconducting circuit in a fully programmable manner. A resonator mediates interactions between the oscillators, whose frequencies are modulated in a prescribed way that the desired coupling between the oscillators is achieved.

Above: In addition to advising students, McMahon is teaching ENGRI 1100 - Lasers & Photonics.

XU LAB SPOTLIGHT

By Jenna Powers

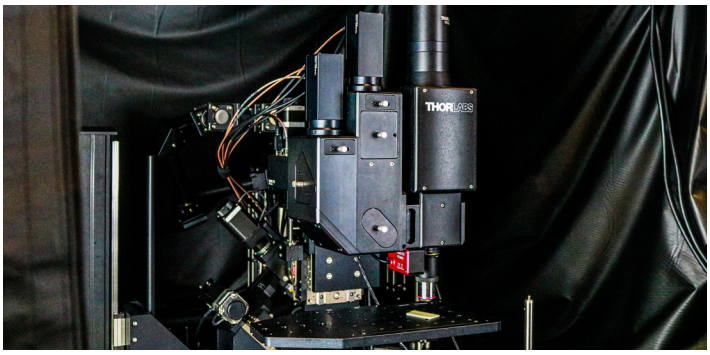
Chris Xu is the Mong Family Foundation Director of Cornell Neurotech-Engineering and the Director of the Cornell NeuroNex Hub. Xu's current research covers biomedical imaging and fiber optics. In the last 10 years, Xu pioneered multiple imaging techniques used to record living animal brain neural activity at single cell resolution. Prior to this, Xu was a member of the technical staff at Bell Laboratories and made seminal contributions to the fiber optic communication systems that are carrying internet traffic today.

Xu's current research builds on his Ph.D. experience studying multiphoton microscopy in Professor Watt Webb's lab. "Webb was completely hands-off and gave his people total freedom to explore. It was in Webb's group that I learned that the fun starts when things are not working as expected, and to experiment is the only way." The Webb lab patented two-photon microscopy, the principle technique for high spatial resolution and deep imaging in the living brain. However, penetration depth of two-photon imaging is limited. "Our knowledge of the brain is really shallow and one major reason is that we literally cannot see anything beyond the superficial layers," explains Xu. The ability to form a sharp focus in brain tissue, despite scattering, is essential for deep imaging.

Xu uses long-wavelength light to reduce the impact of scattering, and three-photon imaging to further sharpen the focus. While the long wavelength and three-photon approach were considered unrealistic by many in the field at the beginning, Xu has shown it is practical and has major advantages in deep imaging of living brains. "The three-photon advantage in microscopy mirrors the advantage of two photons over one photon: the ability to image deeper in the brain. It seemed a little crazy when we first started, but quantitative analysis showed us otherwise, and the experimental results were convincing. We are now able to see things in the living brain that we simply could not see before. There are currently 30 to 40 labs in the world that have adopted this technique to push brain research, and a number of companies have developed a commercial version of the instrument."

Xu is involved with several interdisciplinary endeavors on campus: Cornell Neurotech and the Cornell NeuroNex Hub. Cornell Neurotech, funded by the Mong Family Foundation, aims to develop new technologies to reveal the inner workings of the brain. The Neurotech initiative started with a faculty lunch group between physicists, engineers and biologists. "These lunch discussions reminded me so much of my time at Bell Labs. They are completely freewheeling, and no one is afraid of asking 'stupid' questions. A number of collaborative ideas came out of these meetings." Cornell NeuroNex Hub, one of the collaborative efforts born from the Neurotech group, is an NSF-funded neurotechnology center with a focus on optical technologies for large-scale, noninvasive recording of neural activity. "It is really a no-brainer. Everyone wants to image deeper, faster, and wider." A new collaborative lab was established in Weill Hall: the Laboratory for Innovative Neurotechnology at Cornell (LINC). LINC serves as a testing and development ground where biologists and physicists work together to apply the latest technology for brain research.

Xu's research is supported by major grants from NIH, NSF, DARPA, and IARPA. In addition to publishing more than 300 journal and conference papers, Xu has 32 patents granted or pending. He is a National Academy of Inventors Fellow and an Optical Society of America Fellow. His awards include the NSF CAREER Award, Bell Labs Team Research Award, Tau Beta Pi Professor of the Year Award, and the Cornell Engineering 2017 Research Excellence Award. Xu's work is exemplary of the interdisciplinary, collaborative efforts that Cornell is known for.



Above: Thorlabs Bergamo II Commercial Microscope in the LINC Lab.

Above: Joel Brock with Guebre Tessema, NSF Materials Research Program Director, during the CHESS Users' Meeting facility tour.

Joel Brock, AEP professor and director of the Cornell High Energy Synchrotron Source (CHESS), has seen CHESS through a $15 million facilities upgrade and successful transition to a new funding model. CHESS switched from a solely NSF-funded user facility, to one in which multiple partners fund individual subfacilities. To date, there are three subfacilities: CHEXS @ CHESS, MacCHESS and MSN-C. NSF awarded $54 million in funding to CHEXS @ CHESS (Center for High-Energy X-ray Sciences at CHESS). NIH awarded $17.4 million in funding with up to $2.5 million augmented by the New York State NYSTAR Program to MacCHESS (Macromolecular X-ray science at CHESS). MSN-C (Materials Solutions Network at CHESS) is a new materials research facility made possible by $7.1 million in funding from the Air Force Research Lab (AFRL). "This new funding will help us reach a wider user base," explains Brock, "diverse groups including plant biology, structural materials and advanced manufacturing are eager to utilize a much larger fraction of the nation's available synchrotron resources." The upgrades continue to keep CHESS at the global forefront of X-ray facilities.

Earl Kirkland was awarded the 2019 College of Engineering Faculty Excellence in Teaching Award. Nominations are largely based on student course evaluations and chair recommendation.

Frank Wise has pioneered a fully flipped classroom for AEP 3620 — Intermediate Quantum Mechanics. Flipping the classroom is a form of active learning instruction that utilizes class time to engage students rather than lecture. In an active learning environment, class time is spent on discussions, problem solving, group work and peer instruction. Content delivery is moved outside of the classroom, often through videos or pre-class readings. Research indicates active learning is more effective for student comprehension compared to lecture-based material presentation. Wise has taught AEP 3620 as a flipped classroom for two years now. Student feedback has been very positive in course evaluations. Currently, Upson Hall has facilities to support a flipped classroom. There is potential for installment of an active learning classroom in the Physical Sciences Building.

Above: Images from an Intermediate Quantum Mechanics class utilizing flipped classroom facilities in Upson Hall.

CRAIGHEAD RETIREMENT CELEBRATION SYMPOSIUM

By Syl Kacapyr

Nanoscale scientists and industry professionals gathered in Cornell's Physical Sciences Building June 1 for a symposium to honor the career of nanofabrication pioneer Harold Craighead, Ph.D. '80, the Charles W. Lake Professor of Engineering, who became an emeritus professor July 1, 2019.

Craighead, who became a professor in the School of Applied and Engineering Physics in 1989, focused his research on micro- and nanofabrication and on finding biological applications for the unique microscopic nanostructures he was creating.

In 1997, he was entered into The Guinness Book of World Records after using electron-beam lithography to carve the world's smallest guitar out of crystalline silicon. At 10 micrometers long, the instrument was as small as a human blood cell and demonstrated a new technique for fabricating at the nanoscale. Using similar techniques, Craighead began his most notable work in engineering a nanofluidic device that can separate, count and analyze individual DNA molecules.

Lois Pollack, director of the School of Applied and Engineering Physics, said Craighead's work has been important to the field of biology, especially "what he's done for single-molecule analysis, like DNA sequencing. His ideas, like working on a zero-mode waveguide, really started a brand new way of sequencing DNA and that's had a huge impact."

Craighead used the zero-mode waveguide technology (essentially a nanosized hole in metal film that enables scientists to examine individual DNA molecules) to co-found the company Nanofluidics, which eventually became Pacific Biosciences of California and is valued at more than $1 billion.

Above: Donald Tenant (left) and Harold Craighead (right) during the Symposium.

His lab also engineered devices that can detect single-cell bacteria and viruses, the accuracy of which was demonstrated when Craighead detected the mass of a single E-coli bacterium weighing just 6.3 attograms, an achievement that earned him a second spot in the Guiness Book of World Records, this time for lightest object weighed.

Craighead served as director of his school from 1998 to 2000, director of what is now the Cornell NanoScale Science and Technology Facility from 1989-95, and interim dean of the College of Engineering from 2001-02. Among other accolades, he is a member of the National Academy of Engineering and the National Academy of Inventors.

Through it all, Craighead said it is the relationships he formed that he'll remember most."The most rewarding part of my time at Cornell was the ability to interact with intelligent, bright, active young and older people," Craighead said to symposium attendees, most of whom were former students. "So as I look back at my career, it'll be interactions with all of you that really made it worthwhile."

Christine Tan, Ph.D. '11, was one of several former students invited to present at the symposium. She is the vice president of business development for the Fuzhou Internet of Things Open Lab in China, and said several lessons she learned from Craighead have been helpful throughout her career, including the lifelong curiosity he instilled in her.

"I learned even the simplest thing can be filled with signs and concepts and theories," said Tan. "It's very easy to make assumptions, especially about things we don't know. The onus and responsibility is on us as scientists to really learn, keep an open mind, and really go and find out for ourselves."

"AS I LOOK BACK AT MY CAREER, IT'LL BE INTERACTIONS WITH ALL OF YOU THAT REALLY MADE IT WORTHWHILE."
—HAROLD CRAIGHEAD

Jose Moran-Mirabal, Ph.D. '07, associate professor of chemistry and chemical biology at McMaster University in Hamilton, Ontario, studied the

Above: Steve Turner speaks at reception dinner.

Above: Harvey Tian (right) provided introductory and closing remarks.

interaction between liquid membranes and nanostructured materials as a member of Craighead's research group.

"What I really appreciated from Harold is that he gave you all the freedom to do the stuff you found most interesting," said Moran-Mirabal.

Current postdoctoral researcher Harvey Tian, Ph.D. '17, agreed. "It's been a lot of freedom, but a lot of guidance at the same time. Harold sort of guides you in a way that still makes you feel like you can discover your own way as you go," said Tian, who continues to build microfluidic devices to investigate cancer cells as the last remaining member of Craighead's research group.

Craighead thanked the organizers and those in attendance, including his wife, Teresa, and his son, Daniel. While he won't be teaching in his retirement, he plans to stay active and continue some of his work.

"I don't look at this as the end of something," Craighead said, "but sort of the change of how I operate at Cornell and elsewhere."

Above: Symposium attendees.

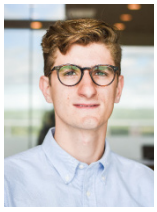
AEP
STUDENTS IN THE SPOTLIGHT

UNDERGRADUATE HONORS STUDENTS

The 2019 class of AEP undergraduates saw seven students defend their honors theses. Lena Kourkoutis, Associate Professor and Director of Undergraduate Studies, oversaw the defenses.

Nicholas Swenson
Quasi-Parametric Amplification using quasi-phase matching techniques

Xella Doi
Investigating magnetic structures in epitaxial thin film Fe1-xMnxGe with transport studies



Nikola Protic
Resonant Photonic Cavity Coupling with Single Photon Emersion in Hexagonal-boron nitride

Joshua Lederman
Simulation-Aided Analysis of Light Emission and Extraction Properties of AlGaN Ultraviolet LEDs

Aryeh Krischer
Tuning Fork AFM for Height Control in Scanning SQUID Microscopy

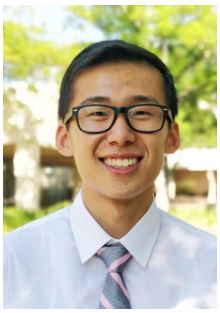
Junlan Lu
Cancerous Tissue Differentiation Using Metasurface-Enhanced Infrared Spectroscopy

Saaj Chattopadhyay
Cryo-Correlative Light and Electron Microscopy to Image Biological Samples

SHARE YOUR STORY

We want to hear from you!

Please submit an update on your journey to our email: AEP_info@cornell.edu



JUNLAN LU RECEIVES NSF GRADUATE RESEARCH FELLOWSHIP AND PEER ADVISOR OUTSTANDING SERVICE AWARD

AEP senior Junlan Lu was selected to be part of the prestigious 2019 NSF Graduate Research Fellowship Program. He began medical physics research in the Radiology Department at Duke University School of Medicine this fall. Lu is using his fellowship to pursue research as a post-doctoral candidate in Bastiaan Driehuyus's Lab. Lu's focus is improving data acquisition using hyperpolarized gas, specifically, xenon (129Xe), in pulmonary MRI technology.

Lu was also chosen as this year's recipient of the Peer Advisor Outstanding Service Award. This award recognizes the work Lu did for the ENGRG 1050 Engineering Seminar and the invaluable impact he made on first-year Cornell engineering students over the course of the year.

GRADUATE STUDENT RESEARCH

The research of AEP graduate student and Guillaume Lambert Lab member David Specht was highlighted in the American Physical Society *APS News* April Bulletin. CRISPR technology uses gene circuits to control cellular gene expression. DNA-binding proteins that regulate gene expression exist in nature but are limited in number and are difficult to engineer. Specht and lab member Yasu Xu developed a technique to study crosstalk between novel gene circuit elements derived from the catalytically-dead CRISPR protein dCas12a. These 'CRISPRgates' are simple NOT gate elements which target genes or other CRISPRgate elements and, in principle, can be combined to create complex genetic circuits. Specht is working to create scalable cascades of these elements that continue to work correctly when utilized in series despite intrinsic leakiness of each element. Specht is using RNA antisense transcripts in order to remove incorrect outfits from the CRISPRgates to prevent these from affecting circuit behavior. The lab's crosstalk technique has expanded to study the binding and specificity of the CRISPR protein and develop a thermodynamic model for its behavior, which has broad applications in gene editing and detection of genetic material.

Above: Specht, Lambert and Xu.

PH.D. STUDENT SPOTLIGHT: NAJVA AKBARI

By Christopher Dawson

Najva Akbari is on her way to becoming an optics expert who applies multi-photon microscopy to biological systems. Akbari is a doctoral student in Professor Chris Xu's research group at Cornell. "I want to find the theoretical limits of three-photon microscopy," says Akbari. This dual focus on theoretical limits and practical applications is a hallmark of AEP. Akbari grew up in Iran and her father is a mechanical engineer. "I really liked electromagnetics in high school," says Akbari. "I asked my physics teacher what I should study in college and he recommended electrical engineering, so that is what I did."

"THERE NEEDS TO BE AN INTERFACE BETWEEN THE TECHNOLOGY AND THE BIOLOGY— SOMEBODY WHO CAN TRANSLATE THE TECHNOLOGY TO BIOLOGY AND MAKE THE BIOLOGICAL EXPERIMENTS HAPPEN."

— NAJVA AKBARI

Akbari earned her B.S. and M.S. in electrical engineering from the University of California, Los Angeles (UCLA). During her years at UCLA, she held two summer internships in industry. "Those jobs helped me see that what I really wanted to do was research and exploratory work," says Akbari. "And to do work like that I would need to get a Ph.D."

Akbari spoke with Chris Xu at a conference and found she was interested in his work. Her advisor at UCLA knew Professor Xu from their days at Bell Labs together. She decided to apply to Cornell, but Akbari also applied to several other doctoral programs and was fairly certain she was going to go somewhere other than Cornell for her degree. "But then I came to visit," says Akbari, "and my plans changed. Cynthia Reynolds [Student Services Program Coordinator] was so attentive and on top of everything. I could see that people in the department were connected in a way I hadn't seen in other schools. It was a real community here."

At Cornell, Akbari knew she wanted to work on imaging technology and methods. Now in her fourth year as a doctoral student, she has hit her stride working with a new three-photon microscope located in Weill Hall. "The goal is to have a user-friendly three-photon microscope that can be adapted to various projects," say Akbari. "There needs to be an interface between the technology and the biology— somebody who can translate the technology to biology and make the biological experiments happen."

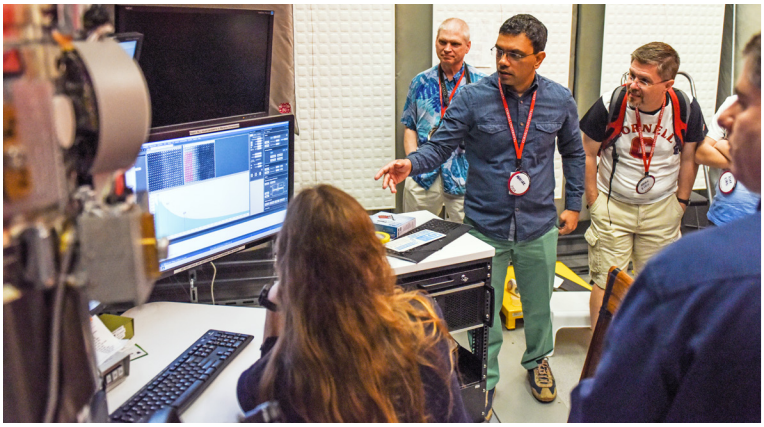
"I WANT TO BE THE OPTICS EXPERT WHO APPLIES PHYSICS TO BIOLOGICAL SYSTEMS."

— NAJVA AKBARI

Akbari is currently using the microscope in her work on two separate projects with professors from Cornell's Department of Neurobiology and Behavior. Her work with Professor Andy Bass focuses on the tiny Danionella Dracula fish, which is relatively transparent and has the smallest known vertebrate brain. With Professor Joe Fetcho, Akbari is using multi-photon microscopy to image an intact living adult zebrafish. Zebrafish are not as transparent, but using multi-photon microscopy Fetcho has been able to "watch" as these zebrafish build their brains and neural networks.

While much less complex than the brains and nervous systems of humans, the neurobiology of dracula fish and zebrafish can teach us much about how our own brains develop and work.

As Bass and Fetcho learn more about these fish, Akbari learns more about the capabilities and limits of three-photon microscopy. Asked about her future plans, Akbari says, "I used to think that I only wanted to be a professor, but now I know that what I really want is the same thing I wanted as an undergrad: to do interesting research and exploratory work. That might mean as a professor, but it could also mean in a different setting. I want to be the optics expert who applies physics to biological systems."



2019 REUNION BREAKFAST

Applied and Engineering Physics alumni and faculty gather for the 2019 Reunion Breakfast, held this past June in the Clark Atrium of the Physical Sciences Building. The Applied and Engineering Physics Alumni Reunion Breakfast is an annual event open to all alumni and held during Cornell University Reunion Weekend.

DONALD TENNANT '73 CNF DIRECTOR OF STRATEGIC INITIATIVES

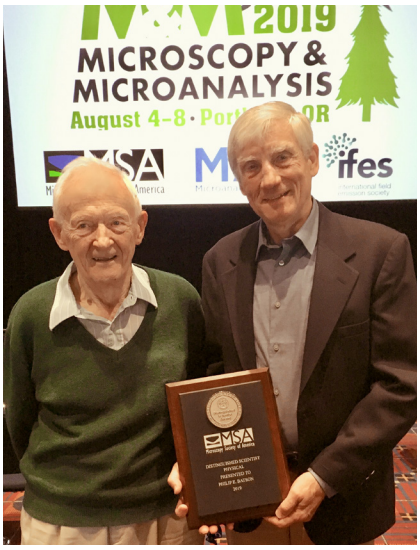
Donald M. Tennant, B.S. '73, is the Director of Strategic Initatives and recently retired Director of Operations at Cornell NanoScale Facility (CNF). At CNF, his efforts focused on leading the facility into new areas of expertise and to offer frontier capabilities to researchers for interdisciplinary projects and education. He was delighted to return to Cornell and has enjoyed working with three CNF Directors and a great many Cornell faculty to initiate new directions and priorities for the facility and its staff. Prior to this, Tennant enjoyed a 27-year career at Bell Labs, where he was a distinguished member of technical staff and managed the Advanced Lithography Group in the Nanofabrication Research Department.

From 1979-2006, Tennant worked at Bell in high resolution electron beam lithography and related nanostructure technology. His work has impacted a wide range of disciplines, including: extreme ultraviolet lithography (EUVL), high precision grating production for DWDM (dense wavelength division multiplexing) optical components, and gate technology for both high performance circuit applications and the exploration of the practical limits of silicon technology.

His collaborative efforts with SUNY Stonybrook and Brookhaven National Laboratories have resulted in important advances in the field of x-ray optics and microscopy. Tennant has authored or co-authored over 200 articles in these fields, organized major international conferences on the subjects, presented numerous invited technical talks and posters, and has been awarded 11 U.S. patents.

Tennant served on the Advisory Committee and as the Financial Trustee for the International Conference of Electron, Ion, and Photon Beams and Nanotechnology (EIPBN). He served on a number of scientific review panels for the National Labs. He is a past chairman of the American Vacuum Society (AVS) Nanoscale Science and Technology Division, and served on the scientific advisory boards for Lawrence Berkeley National Lab's Molecular Foundry and Argonne National Lab's Center for Nanoscale Materials and has served as a panelist for the National Research Council of the National Academies. He is the author of "Tennant's Law."

PHILIP BATSON '76 RECEIVES MSA DISTINGUISHED SCIENTIST AWARD



Above: Batson (right) stands with John Silcox (left) at the Microscopy & Microanalysis 2019 Meeting. Silcox was both undergraduate and Ph.D. advisor to Batson, their working relationship dates from the spring of 1968.

The Microscopy Society of America (MSA) Distinguished Scientist Award is presented to a preeminent senior scientist with a long-standing record of achievement during their career in the field of microscopy or microanalysis.

Philip E. Batson received his Applied Physics Ph.D. in 1976 from Cornell University and performed post-doctoral work at the Cavendish Laboratory in Cambridge, England. He moved to the IBM Thomas J. Watson Research Center from 1978-2009. Here, during the 1980s, Batson built high resolution electron energy loss spectroscopy (EELS) equipment and used it to research spatially resolved EELS (SR-EELS) in the scanning transmission electron microscope, with studies of surface plasmon scattering in metal nanoparticle systems.

In 2002, he was the first to demonstrate sub-Angstrom imaging using aberration correction, for which he was recognized with a 2002-2003 Scientific American Award for Leadership in Imaging Sciences.

Currently, Batson is a distinguished research professor at Rutgers University with appointments in Physics and Materials Science. He is exploring phonon behavior in nanometer-sized structures using EELS with a 10 meV energy resolution. The NSF-sponsored project, in collaboration with Nion, to improve EELS resolution was cited in 2010 by the White House as one of "100 Recovery Act Projects that are Changing America." He has authored over 210 publications and is an American Physical Society and Microscopy Society of America Fellow.

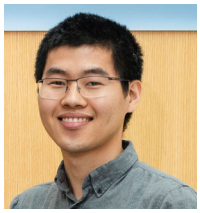
AEP
COMMENCEMENT AWARDS

Applied and Engineering Physics 2019 Commencement Award recipients.

Jeffrey Huang
Trevor R. Cuykendall Memorial Prize
Awarded to an Undergraduate Student for Outstanding Academic Achievement

Monica Xu
David Delano Clark Award
Awarded to a Master of Engineering Student for the Best Master of Engineering Project

Yonghun Lee
Paul L. Hartman Prize in Experimental Physics
Awarded to an Undergraduate Student for Excellence in Experimental Physics



Kaifei Kang
William Nichols Findley Award
Awarded to a Graduate Student for Outstanding Research Paper

Saaj Chattopadhyay
Trevor R. Cuykendall Memorial Prize
Awarded to the Outstanding Teaching Assistant in Engineering Physics

Michael J. Zachman
William Nichols Findley Award
Awarded to a Graduate Student for Outstanding Research Paper

Devon C. Lafferty
Henri S. Sack Memorial Award
Awarded to a Master of Engineering Student for Top Academic Performance

Nicolas Swenson and Assistant Professor Jeffrey A. Moses
Dorothy and Fred Chau Award
Awarded to an Undergraduate Student for Excellence in Research and to a Faculty Member for Excellence in Undergraduate Research Project Supervision

Above: Class of 2019, Applied and Engineering Physics.

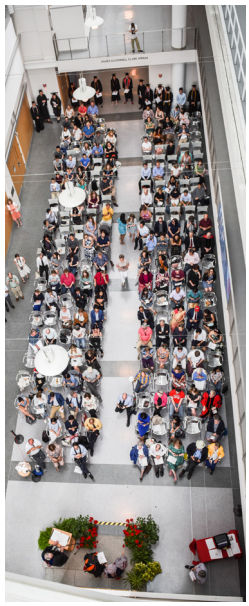







AEP 2019 COMMENCEMENT

Applied and Engineering Physics students and faculty during the 2019 commencement celebration. Photos by AEP and Gary Hodges. Visit garyhodgesphoto.com for purchase.

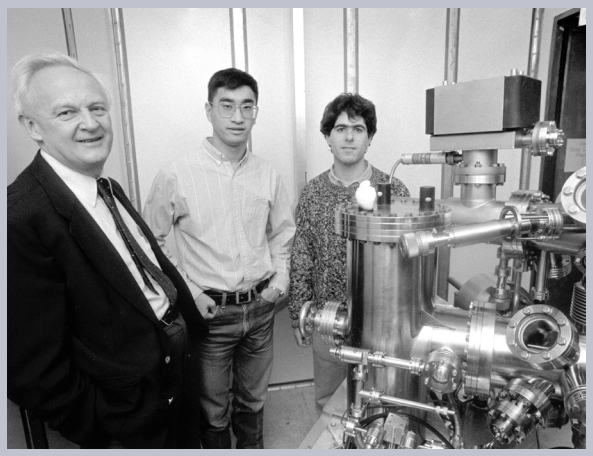








Cornell University
School of Applied and Engineering Physics
271 Clark Hall / 142 Sciences Drive
Ithaca, NY 14853-2501

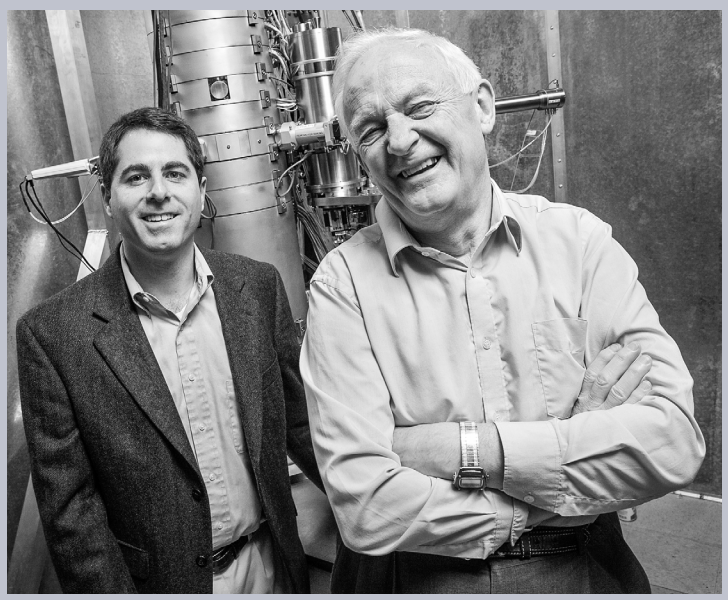
John Silcox, circa 1965.



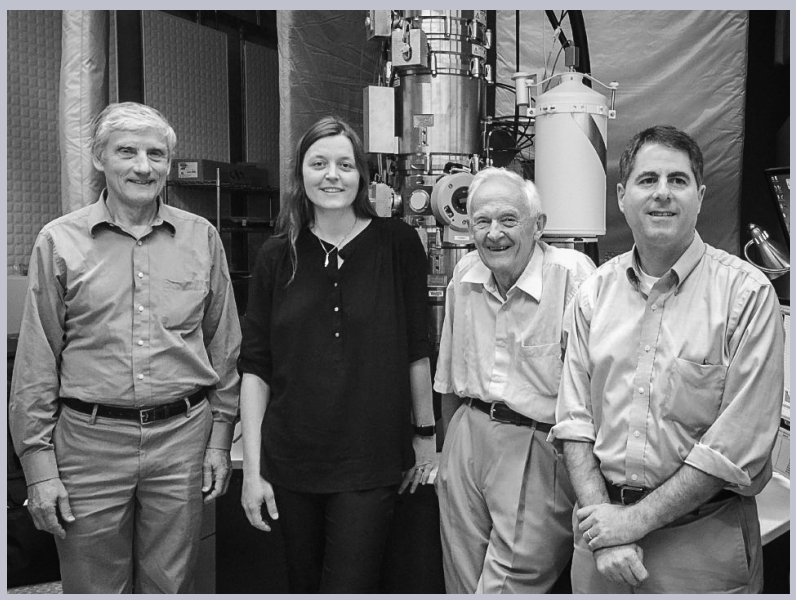
Left to right: John Silcox, Zhiheng Yu & David Muller, 1994.

BLAST FROM THE PAST

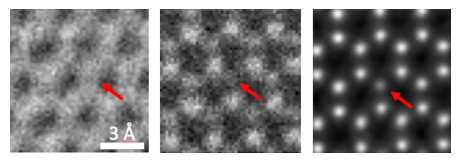
AEP faculty have a history of and continue leading at the cutting-edge of electron microscopy research. During his long career, John Silcox made internationally recognized research contributions to microscopy. David Muller, using the electron microscope pixel array detector (EMPAD) he co-developed, set a world record and established a method for achieving ultra-high STEM resolution. Lena Kourkoutis is at the global forefront of cryogenic microscopy. Plans for installing a new department STEM are in place for 2020.



David Muller (left) & John Silcox (right), 2008.



Left to right: Philip Batson, Lena Kourkoutis, John Silcox & David Muller, 2016.



Left: Electron microscope images of a monolayer of molybdenum disulfide using (from left to right) state-of-the-art imaging methods from 20 years ago, 5 years ago and today, showing improvement in resolution and contrast. The red arrows indicate a site where a single sulfur atom is missing. It is most clearly visible in the newest method, ptychography. Image provided by the Muller Lab.