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Innovator in Electronics

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OPTICAL ENGINEERING LAB

Stuart Yin, professor of electrical engineering, and his research group are focused on developing innovative photonic materials and devices and their applications to broadband communication and sensing networks, multifunctional optoelectronic systems, sustainable and renewable energy systems, and biophotonics. Funding for his research comes from a variety of government agencies including the National Science Foundation, U.S. Army, U.S. Air force, and the U.S. Department of Energy. His research has resulted in a number of significant contributions including:

- An ultrafast, magneto-optic spatial light modulator with sub-ns response time based on nano-engineered, single-domain magneto-optic crystals. This is the fastest magneto-optic modulators ever reported. This innovative device can play a key role in broadband free space optics communications and high speed, high resolution displays.
- An innovative, frequency division multiplexed fluorescence confocal microscope, which not only has a very high spatial resolution over the scattering biomedical media but also a very fast temporal resolution. This will be a very useful tool for biomedical research.
- An ultrafast, all-fiber tunable filter by integrating ultra thin long period grating with nano-composite PVDF terpolymers. The major advantages of this innovative wavelength filter are low insertion loss and fast tuning speed. This novel filter can enable the next generation reconfigurable wavelength division multiplexed broadband networks.
- Harsh environment sensor networks based on gratings fabricated by femtosecond lasers. This unique sensor network can perform distributed sensing at extremely harsh environment (more than 15000C), which is very important for improving the efficiency and reducing the pollutions of power generators such as turbine engines.
- An ultra-fast speed, low grating lobe optical beam steering using unequally spaced phased array technique. This device enables the fast scanning laser radar, which is critical for tracking the fast moving target.

Standoff detection of concealed and buried chemical/explosive devices

One project that Yin's research group is working on is a new technology for the standoff detection of concealed and buried chemical/explosive devices. To enhance national security (e.g., the safety of airlines), one of the most urgent needs is the capability of detecting chemical/explosive devices at standoff distances.

Unfortunately, it is an extremely challenging task to realize standoff detection of concealed and buried explosive devices because (1) the molecular vibrational and rotational signatures of explosive materials are usually at sub-millimeter(mm) levels or have very high frequency electromagnetic waves where propagation loss is high, and (2) the mechanical resonant frequencies of explosive crystal powders are also at high ultrasonic frequencies that have high propagation losses in the air and ground. X-rays and γ -rays are ionic radiations that are not preferred to be used in an open environment due to the potential harmful effects to people. Although there has been a certain degree of success in standoff detection of explosives by detecting at optical frequencies (e.g., using Raman/LIBS Lidars), the direct optical method cannot be employed to detect concealed or subsurface explosives, which represent the majority of explosive devices found in the Iraq and Afghanistan wars. Furthermore, due to the nature of irregular shapes of improvised explosive devices (IEDs), conventional geometric shape based landmine detection methods cannot be directly applied for detecting concealed and subsurface IEDs. Thus, the most reliable detection method is based on detecting the spectroscopic and imaging signatures of explosive materials rather than the shapes of the targets.

To achieve the standoff detection of concealed and buried IEDs, Yin's research group is conducting fundamental scientific and technological studies, including (1) developing a portable and high efficiency mm/sub-mm electromagnetic wave source because such kind of waves not only have the required spectroscopic signatures but also penetrate dielectric materials so that the concealed and buried devices can be detected, (2) exploring new propagation medium and mechanisms that have much reduced propagation loss, which enables long range standoff detection, and (3) investigating new standoff detection methods via the linear and nonlinear interactions of mm waves and the targets.

The successful completion of this research project will represent a major technological breakthrough in standoff detection, which could greatly enhance our national defense and homeland security.

This research is partially supported by the Office of Naval Research.

FACULTY SPOTLIGHT

Tim Wheeler, research assistant, has a diverse background. Originally from Chappaqua, NY, Wheeler earned his A.B. (bachelor's degree) in Slavic languages and literature from Princeton University in 1975. "It was an exciting time to learn Russian," comments Wheeler, "My high school, like many at the time, were instituting Russian programs. The Russian teacher had been a CIA agent. He was enormously charismatic. I loved his program." Continuing this program of study was natural. "At Princeton, the Slavic program was well established. The department head had written the authoritative book on the linguistics of the language."



Upon graduation, Wheeler traveled to Alaska with three of his Princeton classmates to climb Mt. McKinley. The group attained the summit in 42 days. Alaska had made its mark on Wheeler and he stayed for the next eight years. Wheeler joined the enormous Alaskan fishing industry fishing for shrimp, salmon, herring, and king crab in Kachemak Bay, Prince William Sound, and Bristol Bay. After several years, Wheeler became a skipper of a boat. Realizing that to proceed any

further in the fishing industry, he would have to buy his own boat, Wheeler turned to a land-based trade. Wheeler designed and built the first super-insulated house in Homer, AK. Wheeler explains, "I built my house to learn carpentry, wiring, and plumbing. Those were fun, but the part that was most fun was design and all that went into it. Thus, I was propelled back to school."

Wheeler earned his bachelor's degree in electrical engineering from Cornell University in 1989. He was drawn toward the Space Plasma Physics Group at Cornell and was hired to help with the editing of a textbook. He joined the Department of Electrical Engineering at Penn State in 1995. Initially, he built electric field sensors and particle detectors for ionospheric and mesospheric research rocket payloads. Along with **Professors Jack Mitchell and Charlie Croskey**, he developed the Student Projects Involving Rocket Investigation Techniques (SPIRIT), guiding undergraduate students to build three successful rockets that flew up to 150 km. Wheeler said, "Along with the rockets, the SPIRIT program launched many technical careers, several personal relationships and quite a few white hairs." Currently, Wheeler is the course coordinator for the senior design lab and oversees the sponsored projects sections in cooperation with the Learning Factory. He is associate director of the Student Space Programs Laboratory, co-director of the Service Learning Certificate, and director of the Penn State Engineering Projects in Community Service (EPICS) Program. Wheeler really enjoys working one-on-one with the students. He wants to ensure that the array of projects and project-based programs available for electrical engineering students continues. Wheeler believes that this is presently an area of strength for the electrical engineering department that is insufficiently recognized. Wheeler states, "The Student Space Programs Lab is a terrific resource that has inspired many students to pursue space-related careers." Wheeler would like to take his experience with the SPIRIT program and build the EPICS program for electrical engineering students who would like to build a career that is both technical and humanitarian in nature.

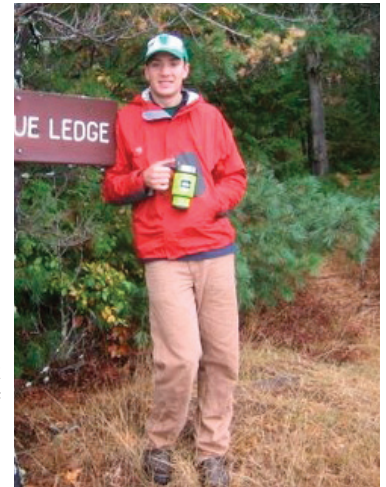
"In my 15 years here, my job has evolved from engineering to teaching," stated Wheeler. "I feel like I have thrived and I am grateful for the opportunities I have had to put my energies to work. Education is an endlessly fascinating undertaking — as varied and complex as the student body is. It is exciting to see our students lift their eyes up and realize just how big this world is, just how much we don't know about it yet, and what a lot needs to be done to assure our future. Engineers must take a leading role! It all begins right here."

Wheeler and his wife, Eileen, agricultural engineering professor, have two sons and live in Port Matilda with their dog and two cats. His hobbies include photography, racquetball, and Sacred Harp singing.

STUDENT SPOTLIGHT

Aaron Vallett, Ph.D. candidate in electrical engineering, is multifaceted. After graduating as valedictorian of his high school, Vallett attended the University of Vermont with support from the Green & Gold scholarship and the IBM Thomas J. Watson Memorial Scholarship.

Upon receiving his bachelor's degree in electrical engineering in 2005, Vallett selected Penn State for his graduate work because of the nanofabrication facilities and the strong research in nanoelectronics. At Penn State, Vallett has been awarded a number of fellowships including the Monkowski Graduate Fellowship for four years.



Vallett is certainly a committed student. "I've always been motivated to do my best job in school at every level, and certainly my parents helped me develop this attitude at a young age. I also get a great deal of satisfaction by working hard and creating a good product whether that was an A on a test, a well-written paper, or a working device in lab," commented Vallett.

Vallett is a research assistant in **Theresa Mayer's research group**. His work has centered on experimental studies of the physics of nanowire-based tunneling transistors, which are a leading candidate to one day replace the traditional metal-oxide-semiconductor field-effect transistors used in electronic devices. The benefit of the tunnel field-effect transistor is that it reduces power consumption, allowing low-power computer design and improved battery life in portable electronics.

This research has led to a number of publications. Most recently, Vallett presented "Fabrication and Characterization of Axially-Doped Silicon Nanowire p-n Junctions," which is co-authored with **Sharis Minasian, Huichu Liu, Associate Professor Suman Datta, Professor Joan Redwing, and Professor Theresa Mayer**, at the Materials Research Society meeting on April 7, in San Francisco, CA. This summer, Vallett is traveling to South Bend, IN, for the Device Research Conference where he will present "Fabrication of Axially Doped Silicon Nanowire Tunnel FETs and Characterization of Tunneling Current," which is co-authored with **Minassian, Datta, Redwing, and Mayer**.

In additional experience, Vallett was a graduate assistant for Applied Research Laboratory, a visiting research assistant at Sandia National Laboratories, and an undergraduate research assistant at the University of Buffalo. In an industry collaboration effort, Vallett has partnered with IBM Microelectronics to examine the doping profile of the nanowires used in his research.

Upon graduation, Vallett would like to work for a semiconductor company as a device engineer or might be interested in a position at a government lab. Originally from Vermont, Vallett is an avid skier and outdoorsman, and can be found at weekly basketball games at the YMCA. He enjoys hiking, backpacking, and traveling with his wife, Laura, and their black labrador retriever.

DEPARTMENT UPDATES

Commencement Speaker

Tom Roell, Penn State electrical engineering alumnus, will be the spring commencement speaker for the College of Engineering graduation ceremony on May 14. Roell has more than four decades of experience in corporate management, project management and business management. Currently, he is the group executive for operations and risk at Parsons Corp, an engineering and construction firm. Roell has served in a number of roles at Parsons Corp., including president of its infrastructure and technology group, senior vice president and manager of operations for infrastructure and technology and manager of constructors and fabricators. Prior to joining the Pasadena, CA-based firm, Roell worked at Fluor Federal Services and Westinghouse Electric. Roell has played an active role in the electrical engineering department, including serving on the Industrial and Professional Advisory Council since 2008.



Optical Wireless Applications Workshop on Establishing a National Science Foundation Industry/University Cooperative Research Center

This workshop will be held on June 8-10 at the Penn-Stater Conference Center Hotel in State College.

Under the auspices of the National Science Foundation, Penn State, Tufts University and the University of California Riverside are collaborating to establish an Industry/University Cooperative Research Center, with Penn State as the lead institution. This is a planning meeting to discuss the potential to establish an interdisciplinary research center, providing leadership to develop a new generation of environment-friendly, extremely wideband optical wireless technology applications, and employing solid-state devices for communications, networking, imaging, and remote sensing applications.

This workshop will be of interest to engineers, leaders and executives in visionary companies that have a goal to extend and enhance their products and services with newly designed optical sources, transmitters, detectors and receivers.

For more information, please visit the workshop website: <http://cictr.ee.psu.edu/workshop-owa>

Christopher Raspanti Memorial Lab dedication

There will be a formal dedication of the new Christopher Raspanti Memorial Digital Signal Processing/Digital Music Lab on Friday, May 21, at 3:30 p.m. in 204 Electrical Engineering West building.

Christopher Raspanti was an Electrical Engineering student at Penn State from 2002 to 2005. He had a strong interest in digital music and planned to specialize in digital signal processing. Chris passed away unexpectedly in 2005 while a student at Penn State. After his death, Chris's family established a memorial fund to purchase equipment for the lab in his memory.

Please join the department and Chris's family for the dedication. Light refreshments will be provided.

Penn State Engineering Alumni Society Awards

Stuart Yin, professor of electrical engineering, was awarded the Penn State Engineering Alumni Society Premier Research Award (PSEAS). This award recognizes and rewards an individual whose contributions in scientific knowledge through research are exemplary and internationally acclaimed. These research awards are established to confer honor on individuals who, by their contributions to knowledge, have brought recognition to themselves, the College and Penn State.

Aylin Yener, associate professor of electrical engineering, was awarded the PSEAS Outstanding Research Award. This award recognizes and rewards outstanding engineering researchers for accomplishments in advancing the frontiers of knowledge. These research awards are established to confer honor on individuals who, by their contributions to knowledge, have brought recognition to themselves, the College and Penn State.

A. J. Ferraro Graduate Research Award

Sebastien De Larquier and **Zikri Bayraktar**, graduate students in electrical engineering, received the A. J. Ferraro Graduate Research Award presented at the Communications and Space Sciences Laboratory's annual Waynick lecture on April 30.

De Larquier, who is completing his master's of science degree in electrical engineering, received the award for his research in remote sensing and space sciences. His adviser is **Professor Victor Pasko**.

Bayraktar is working on his doctoral degree in electrical engineering and received the award for his research in electromagnetics. His adviser is **Professor Doug Werner**.

This is the 11th year that graduate students have been recognized for their research with awards honoring Ferraro on his retirement. Contributions to this fund are always appreciated. Checks should be made out to Penn State with a notation in the memo line of the check for "The A. J. Ferraro Graduate Research Award." Mail to the Communications and Space Sciences Laboratory, 316 Electrical Engineering East, University Park, PA 16802.

Bloom Award Winners

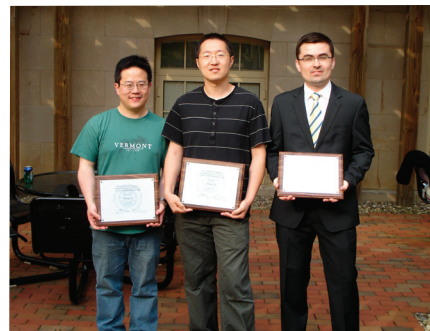
Congratulations to the Electrical Engineering Melvin P. Bloom Memorial Outstanding Doctoral Research Award winners:

Zikri Bayraktar – Adviser, **Professor Doug Werner**

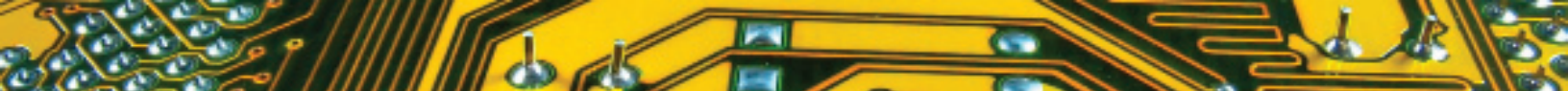
Xiang He – Adviser, **Associate Professor Aylin Yener**

Sheng Liu – Adviser, **Distinguished Professor Qiming Zhang**

The purpose of this fellowship is to recognize and provide financial assistance to outstanding graduate students who have been admitted to Penn State as candidates for a graduate degree in the Department of Electrical Engineering.



Xiang He, Sheng Liu, and Zikri Bayraktar



Please note change in meeting date:

**Society of Penn State Electrical Engineers
SPSEE Spring Meeting**

Friday, June 11

11:30 a.m.-1:30 p.m. (light lunch will be provided)

101 Electrical Engineering East

Items on the agenda include:

Mentoring program

Early Career Recognition Alumni Award

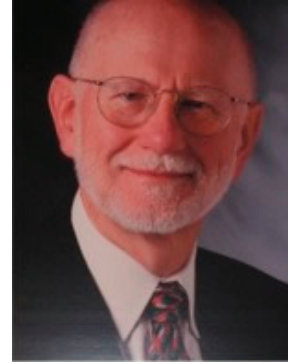
Alumni Volunteer Opportunities

Committee Reports

Follow this link to register on-line or call Cathy: 814-863-0253

OUTSTANDING ENGINEERING ALUMNI AWARD

Vytas Pazemenas was posthumously honored in April with a College of Engineering Outstanding Engineering Alumni Award. The Penn State Outstanding Engineering Alumni Awards recognize graduates who have reached exceptional levels of professional achievement. Established in 1966, the award is the highest honor bestowed by the College of Engineering.



Pazemenas received his bachelor's degree from Penn State in electrical engineering in 1961. He was the founder and CEO of Aubrey Group, Inc., a contract engineering and manufacturing firm specializing in the development of medical devices. Aubrey Group, located in Irvine, CA, has developed more than 50 medical devices, including DNA identification instruments, high-intensity focused ultrasound cardiac ablation systems for curing atrial fibrillation, ventricular assist device controllers, core body temperature controllers and many others.

Before founding Aubrey Group, Pazemenas was the vice president of engineering and research and development, for two medical companies: CareLink and Tokos Medical. Earlier in his career, he was the director of design engineering at Nellcor, the pulse oximetry company, and has also held senior engineering and management positions at Oximetrix, Abbott Laboratories, and GTE Sylvania Electronic Systems. He was also a guest lecturer in biomedical engineering at University of California, Irvine.

Pazemenas passed away on Oct. 23, 2009, at the age of 71.

DID YOU MISS THE WAYNICK LECTURE?

David R. Smith was the presenter for the 2010 Arthur H. Waynick Memorial Lecture series on April 30 on the University Park campus. Smith is the William Bevan Professor of Electrical and Computer Engineering at Duke University and serves as director for the Center for Metamaterial and Integrated Plasmonics

His talk was titled "Modern Day Alchemy with Metamaterials: Invisibility Cloaks and Superlenses." The event was recorded and can be viewed here: <http://live.libraries.psu.edu/mediasite/Viewer/?peid=65f1596e310e404aa0c152d4948cfdb7>

EARLY CAREER RECOGNITION ALUMNI AWARD

The deadline is near!

An Early Career Recognition Alumni Award has been created to honor outstanding Penn State electrical engineering alumni at the outset of their career. This is an exciting new way to recognize our alumni. Nominations are due by May 15 and can be made by anyone with knowledge of the career progression and accomplishments of the nominee.

The nomination form as well as award criteria will be sent as an attachment to the e-newsletter. In addition, forms are available in the electrical engineering office and can be mailed or faxed upon request.

Please contact Cathy McClellan, cls118@psu.edu or 814-863-0253. We look forward to hearing all the wonderful things that our alumni have accomplished.

HAVE YOU SEEN THE ELECTRICAL ENGINEERING WEBSITE LATELY?

We have a new look! Check it out: <http://www.ee.psu.edu>

There are three videos on the website featuring both undergraduate and graduate students. Also, alumni can sign up for events, such as the mentoring program and SPSEE meetings. Let us know what you think!

Mark Your Calendar:

- May 8 College of Engineering sponsored "City Lights" In WDC
- May 14-16 Spring graduation at University Park
- May 21 Christopher Raspanti Memorial Lab dedication
- June 4-6 Penn State Alumni Association Traditional Reunion Weekend
- June 8-10 Optical Wireless Applications workshop
- June 11 SPSEE meeting

Contact Information:

Department of Electrical Engineering, 121 Electrical Engineering East, University Park, PA 16802, Phone: 814-865-7667, FAX: 814-865-7065

Web: www.ee.psu.edu

Please submit news items to: Cathy McClellan at cls118@psu.edu

This publication is available in alternative media on request.

Penn State is committed to the affirmative action, equal opportunity, and the diversity of its workforce.

U.Ed. ENG 10-83