NPRE ILLINOIS
DEPARTMENT OF NUCLEAR, PLASMA, AND RADIOLOGICAL ENGINEERING

FALL 2018
NEWSLETTER FOR ALUMNI & FRIENDS

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DEPARTMENT OF
NUCLEAR, PLASMA, AND RADIOLOGICAL ENGINEERING

faculty

Rizwan Uddin | department head | professor

Jean Paul Allain | associate head, graduate programs | professor

Brent J. Heuser | associate head, undergraduate programs | professor

Shiva Abbaszadeh | assistant professor

Daniel Andruczyk | research assistant professor

Caleb S. Brooks | assistant professor

Davide Curreli | assistant professor

Angela Di Fulvio | assistant professor

Kathryn D. Huff | assistant professor

Tomasz Kozlowski | associate professor

Ling-Jian Meng | professor

Zahra Mohaghegh | assistant professor

Magdi Ragheb | associate professor

David N. Ruzic | professor

James F. Stubbins | professor

Yang Zhang | associate professor

affiliated faculty

Jont Allen | Electrical & Computer Engineering professor

Michael Aref | adjunct assistant professor

Robert S. Averback | Materials Science & Engineering professor emeritus

Roy A. Axford | professor emeritus

Jeffrey L. Binder | adjunct professor

Stephen A. Boppart | Bioengineering professor

Thomas J. Dolan | adjunct professor

J. Gary Eden | Electrical & Computer Engineering professor

Masab H. Garada | adjunct assistant professor

Barclay G. Jones | professor emeritus

Brian E. Jurczyk | adjunct research assistant professor

Michael D. Kaminski | adjunct lecturer

Ernest John Lowry Kee | research associate professor

Susan M. Larson | Engineering administration assistant dean

Charles P. Marsh | adjunct professor

George H. Miley | professor emeritus

David W. Miller | adjunct assistant professor

Richard F. Nelson | adjunct assistant professor

Martin J. Neumann | adjunct assistant professor

William R. Roy | adjunct lecturer

Clifford E. Singer | professor emeritus

Michael W. Stowell, Jr. | adjunct research associate professor

Robert A. Stubbers | adjunct research assistant professor

Clair J. Sullivan | adjunct research assistant professor

Dallas R. Trinkle | Materials Science & Engineering professor

Surya P. Vanka | Mechanical Science & Engineering professor emeritus

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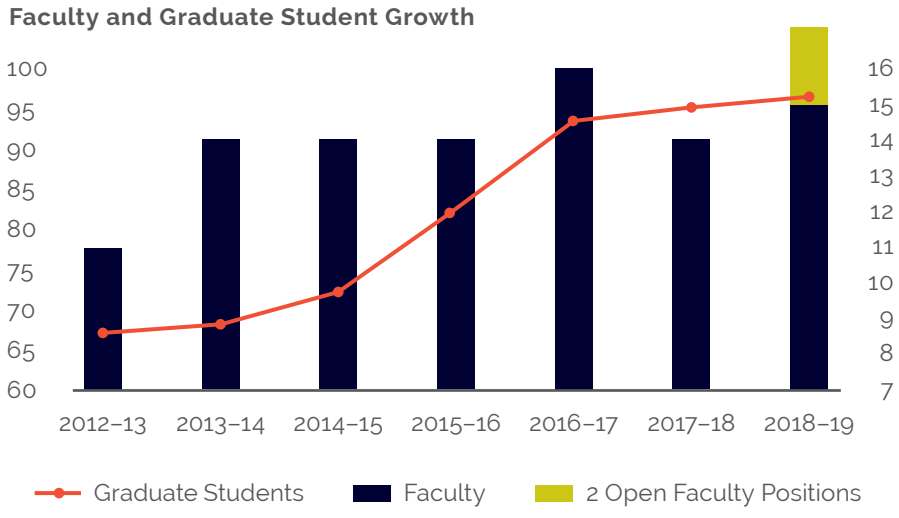
ILLINOIS

Graduate student enrollment grows

The growth of NPRE's faculty over the past several years has translated into a steady growth of NPRE graduate students in both number and the types of research that students are conducting. The chart shows how current graduate student numbers are rivaling those of historically high numbers from the 1970s.



Dear Alumni and Friends:

If you are like me, the cover photo on this edition of the NPRE newsletter should bring a smile to your face. We are happy to feature several of our graduate students—a group that is diverse, large in number, and outstanding in ability. This year we are just a few short of 100 graduate students, a count that rivals our highest historic numbers dating back to the mid 1970s. The quality of our students is even more impressive. Several have gained prestigious fellowships, and their research work is being recognized, winning recent competitions.

Of course, it is the outstanding faculty that have joined NPRE over the past several years that have attracted these remarkable graduate students. We continue to grow the faculty, having added Prof. Angela Di Fulvio (*see page 4*) this year for our radiological sciences path, and are actively searching for two more tenure-track faculty members to join our team.

As has been the case for each of the last several years, NPRE faculty members have been rewarded in 2018 with honors from the American Nuclear Society and other national organizations, the University of Illinois Urbana campus, and the College of Engineering (*see IMPACT, starting on page 11*). Beyond the accolades, NPRE faculty have pursued research that advances safe and economical nuclear power, explores the promises of plasma/fusion technologies, and expands our efforts in radiological sciences, while they have dedicated themselves to creating fulfilling educational experiences for our undergraduate and graduate students.

Among top priorities has been welcoming and encouraging undergraduates to join research programs (*see page 10*). Three weeks into the semester, I was very pleased to see nearly half the freshman class raising their hands when I asked them who had initiated an effort to join a research group. Many were already in one. By the end of this academic year, I hope that everyone's hands will be up. At the same time, we are urging more NPRE students to do summer internships. And, to continue to attract new high caliber students to our program, NPRE held its first week-long high school summer camp this year in conjunction with Worldwide Youth in Science and Engineering (*see page 16*).

"Great students become alumni who then often contribute greatly to science and society."

Rizwan Uddin

Great students become alumni who then often contribute greatly to science and society. This is true of John Kotek and Mark Zediker, recognized this year by the College of Engineering, and Craig Laughton and Brad Radl, honored by NPRE (*see pages 13, 14*). For alumni such as Phi Nguyen, the journey to success can lead to recognizing and thanking those who helped most along the way (*See Mother's Courage, pages 18–19*).

NPRE is continuing its historical role of leadership—now in more ways than ever before. It is my hope that, after reading these pages, you will share in my pride of being part of NPRE.

Sincerely,

Rizwan Uddin

NPRE TEACHERS RANKED AS EXCELLENT BY THEIR STUDENTS

Fall 2017

Daniel Andruczyk
Davide Curreli
William R. Roy
David N. Ruzic
James F. Stubbins
Rizwan Uddin
Yang Zhang

Spring 2018

Richard L. Holm
David N. Ruzic
Rizwan Uddin
Yang Zhang

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Angela Di Fulvio joins NPRE faculty

NPRE's radiological sciences path continued to grow this fall with the hiring of Assistant Prof. Angela Di Fulvio, an expert in radiation detection for both medical physics, nonproliferation and homeland security applications.

Di Fulvio comes to NPRE from the University of Michigan. As a Research Scientist in the Department of Nuclear Engineering and Radiological Sciences there, her work revolved around neutron detection, simulation, and measurements for a variety of applications, ranging from nonproliferation and safeguards, to therapeutic radiology.

Di Fulvio earned her PhD in 2012 from the University of Pisa, Italy, focusing her studies on the experimental characterization of neutron beams for Boron Neutron Capture Therapy (BNCT) within the framework of the SPES-BNCT project at the Italian Institute of Nuclear Physics. As a postdoctoral researcher at Yale University, she developed superheated-emulsion-based detectors for homeland security applications.

The new professor will establish the Neutron Metrology Laboratory in the Digital Computer Laboratory building on the Urbana campus. The facility will include a DT neutron generator and instruments enabling detection of neutrons by proton scattering or by uranium nuclei fission.

For more on this story, go to go.npre.illinois.edu/difulvio_joins_NPRE.

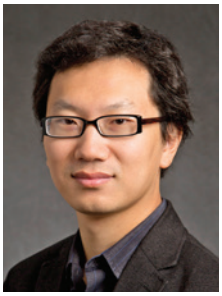
Allain chosen as ILEE Fellow

Prof. JP Allain has been appointed a Fellow of the new Innovation, Leadership and Engineering Entrepreneurship degree program in the College of Engineering to assist in the new program's growth and implementation.

The new degree from the college's Technology Entrepreneur Center is intended for engineering students to better understand the innovative processes involved in identifying complex technical problems and creating, developing, and leading efforts to provide engineering solutions.

For more details on Allain's startup firm, Editekk Inc., go to www.editekk.com.

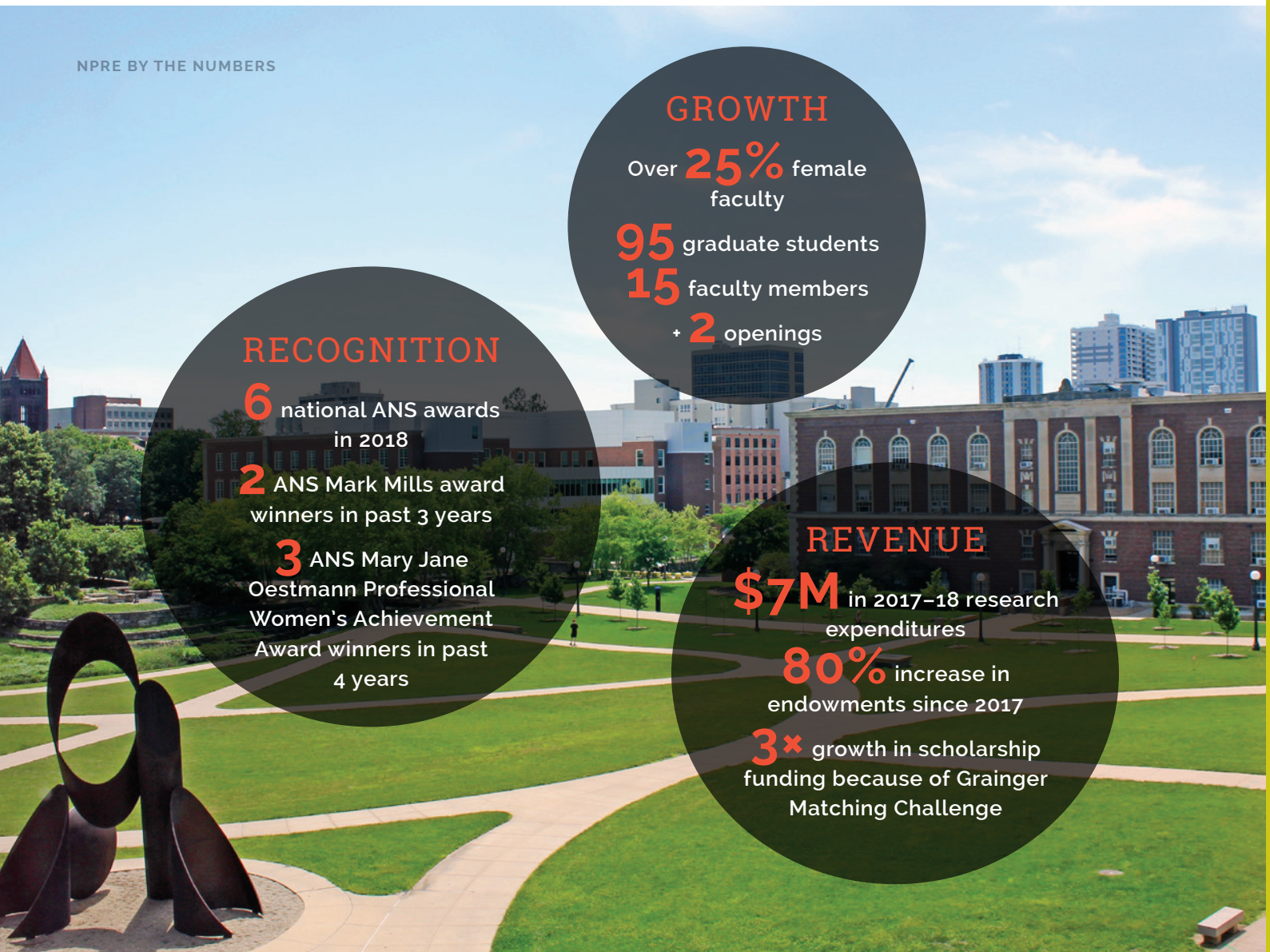
Zhang gains NPRE promotion



Yang Zhang has been promoted from assistant to associate professor with tenure, and also heads the Computational Molecular Science Group at the Beckman Institute for Advanced Science and Technology.

Having joined NPRE in 2012, Zhang has focused on the study of the physics and chemistry of liquids, especially under extreme, interfacial, or non-equilibrium conditions, using integrated atomistic theory, computation, and neutron and X-ray experiments.

For more on this story, go to go.npre.illinois.edu/zhang_promotion.



Nuclear Power

MOLTEN SALT REACTORS—MEITNER

The newest generation of nuclear reactors will need to lower their output during times of reduced electricity demand. NPRE researchers are examining ways to enable these load-following capabilities by removing unwanted fission by-products from molten salt reactors (MSRs).

Assistant Prof. Kathryn Huff leads the team in a $999,000 grant from the U.S. Department of Energy's Advanced Research Projects Agency-Energy (ARPA-E). The team will use simulations and experiments to establish a design for reprocessing molten salt fuel, thereby removing a major barrier to commercializing MSRs.

Huff will simulate the reactor's fuel cycle. Associate Prof. Tomasz Kozlowski will conduct load-following simulations. Assistant Prof. Caleb Brooks will examine the system's computational fluid dynamics. Profs. Jim Stubbins and Brent Heuser will oversee experimental work.

The project is funded by ARPA-E's Modeling-Enhanced Innovations Trailblazing Nuclear Energy Reinvigoration (MEITNER) initiative, which seeks to develop innovative technologies that can help ensure advanced reactors have a path to commercial viability.

For more details, go to go.npre.illinois.edu/molten_salt_reactor_research.

Caleb Brooks

Brent Heuser

Katy Huff

Tomasz Kozlowski

Jim Stubbins

This capability would make it possible to vary the reactor power output with very little required recovery time, allowing MSR reactors to load follow.

NUCLEAR POWER PLANT HEAT RE-PURPOSED FOR AG NEEDS

NPRE and Crop Sciences researchers have teamed with Exelon Corporation to examine whether heat lost from nuclear power generation can be re-purposed for greenhouses or biofuel production.

Approximately two units of heat are discharged for every unit of electricity nuclear power plants produce, according to NPRE Assistant Prof. Caleb Brooks. "Currently, all power plants discharge a lot of heat into the environment. There are several possibilities to reutilize the energy instead of allowing it to dissipate. We're looking at possible agricultural uses for that discharged heat."

Joining Brooks in the year-long study are NPRE Assistant Prof. Katy Huff and Andrew Margenot, assistant professor of soil science in the College of Agricultural, Consumer & Environmental Sciences.

Exelon is interested in the project as a means to increase revenue.

For more details, go to go.npre.illinois.edu/nuclear_greenhouse_biofuel.

MOHAGHEGH LEADS IN IAEA COORDINATED RESEARCH

Managing risk due to pipe failures is an important consideration for nuclear power plants.

Assistant Prof. Zahra Mohaghegh and her Socio-Technical Risk Analysis (SoTeRiA) Laboratory have joined a team of international collaborators to study this topic. The Illinois group will apply Probabilistic Risk Assessment (PRA) modeling to evaluate the likelihood of pipe failures for risk informing reactor designs, and for enhancing risk management insights for maintenance, inspection programs and improved risk management.

The International Atomic Energy Agency (IAEA), which assists research for peaceful uses of nuclear energy and the development of practical applications throughout the world, is sponsoring the project.

For more details, go to go.npre.illinois.edu/Mohaghegh_IAEA.

STUDENT PROJECT REDUCES REACTOR CORE VIBRATION

A project to reduce vibration between fuel rods in nuclear reactor cores won the Daniel F. Hang Outstanding Senior Design Award over the Spring 2018 semester. NPRE students Joel Brassfield, Emily Gordon, Holly Hernandez and Salvador Rosas, students of Nuclear, Plasma, and Radiological Engineering, contributed to the project, "Vibration Reduction Bracing System (VRBS)."

The team designed a vibration reducing bracing ring system (VRBS) to be placed between four fuel rods, positioned between fuel assemblies in order to disperse the turbulence-based forces responsible for grid-to-rod fretting.

For more details, go to go.npre.illinois.edu/2018HangAward.

Plasma/Fusion

PLASMA PROCESSING EXPLORED IN AUTOMOTIVE MATERIALS

The Center for Plasma-Material Interactions (CPMI) local company Starfire Industries have teamed with General Motors Co. and the U.S. Department of Energy to apply plasma processing in producing lightweight automotive materials.

A gluing process being considered to bond materials such as aluminum, magnesium and/or carbon fiber composites is aided greatly when first subjected to plasma processing. The plasma treatment creates a chemical, electron-sharing-covalent bond between the atoms of the material and the glue. When tested, the bond in plasma-treated samples have held strong.

The development of plasma at atmospheric pressure as opposed to a vacuum system is becoming more commonplace, making the process more feasible to use in a manufacturing setting, said Professor David Ruzic, who directs CPMI. Starfire Industries, co-founded by NPRE alumni Brian Jurczyk and Robert Stubbers, builds the microwave power supplies and plasma torches that automotive makers can use in plasma processing.

Post-doctoral research associates and students work on the plasma torch project.

For more details, go to go.npre.illinois.edu/cpmi_starfire_research.

PLASMA MODELING TO AID IN ENHANCING STEEL PROPERTIES

Assistant Prof. Davide Curreli's plasma modeling research for Posco, a large South Korean steel manufacturer, could lead to innovative steel processing.

Curreli is collaborating with Dr. Sangwon Lee, Principal Researcher in Posco's Thermo-Fluid and Process Research Group, and visiting scientist at NPRE.

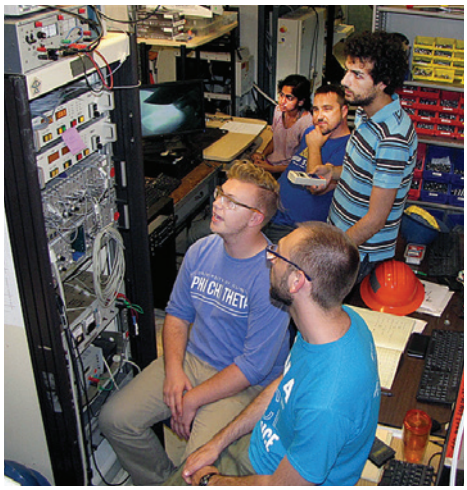
Posco is interested in using an innovative plasma technology to deposit special ceramic coatings onto steel to greatly improve the manufacturing process and help with improving the microstructure of steel products. The process needs to happen at atmospheric pressure in facilities handling continuous processing of steel.

For more details on this story go to go.npre.illinois.edu/plasma_modeling_steel_enhancement.

HIDRA TESTING LIQUID LITHIUM FUSION REACTOR EXPERIMENTS

NPRE researchers working with the University of Illinois HIDRA plasma/fusion facility are using HIDRA to run experiments on techniques designed to advance fusion reactors.

NPRE Research Assistant Prof. Daniel Andruczyk and his team have opened HIDRA for installation of liquid lithium experiments from Princeton Plasma Physics Laboratory (PPPL) and the Center for Plasma-Material Interactions (CPMI) at Illinois. Splitting HIDRA's vacuum vessel in half allows larger components to be installed and the experiments to be tested simultaneously.



Both PPPL and CPMI propose using lithium as the material that first comes into contact with plasma in a fusion reactor.

Once the systems are tested on HIDRA, they will be further tested on the Experimental Advanced Superconducting Tokamak (EAST) at the Institute of Plasma Physics in the Chinese Academy of Sciences (ASIPP).

For more details, go to go.npre.illinois.edu/hidra_lithium-tests.

NANOMATERIALS STUDY MAY LEAD TO UNDERSTANDING ASTEROID, MOON ORIGINS

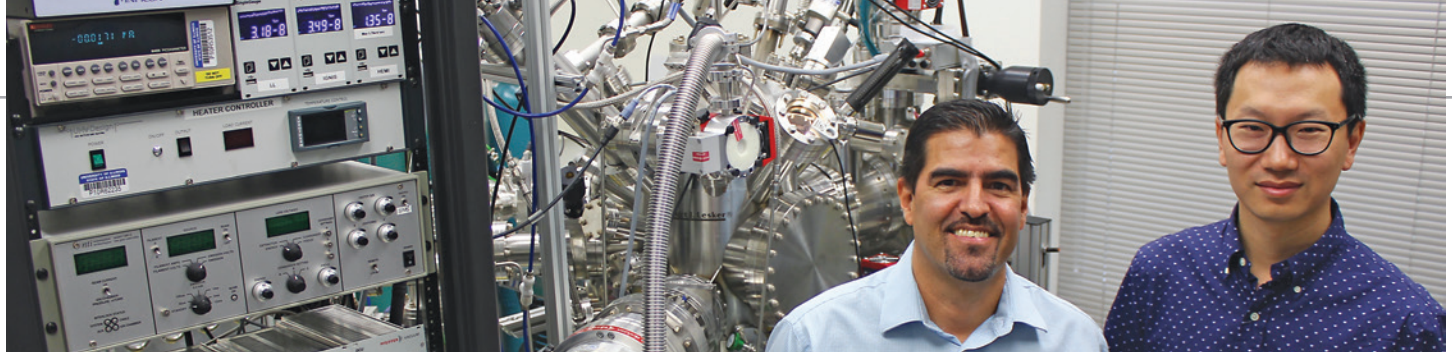
Prof. J.P. Allain's expertise in examining radiation effects on the surfaces of nanomaterials may help unlock mysteries of the origins of huge heavenly bodies, such as asteroids and moons.

Allain has joined a $5.5 million National Aeronautics and Space Administration-funded project that the Arizona-based Planetary Science Institute leads. The institute's Toolbox for Research and Exploration (TREX) project will develop research methods to prepare for human exploration of the Moon, near-Earth asteroids, and the Martian moons Phobos and Deimos.

Allain's group is investigating fundamental particle-driven synthesis while diagnosing a material's surface structure and composition using the custom-designed IGNIS facility, which can expose surfaces to a collection of energetic particles under high-pressure and high-temperature environmental conditions and characterize them in-situ.

The group is examining lunar samples collected during the U.S. Apollo missions and surrogate minerals such as olivine, as well as samples from an asteroid mission the Japanese conducted in 2007 of the near-earth asteroid Itokawa.

For more details, go to go.npre.illinois.edu/allain_moon-origin-study.



PLASMA-MATERIAL INTERACTIONS OBSERVED DURING EXPOSURE TO FUSION REACTOR CONDITIONS

NPRE researchers JP Allain and Yang Zhang are breaking ground in fusion energy science by developing the means to examine material surfaces as they are being exposed to the dynamic and extreme conditions of thermonuclear tokamak plasmas.

Allain and Zhang will use non-charged particles with x-rays and neutrons within the fusion environment. They will test the x-ray phase of the research in the IGNIS facility housed in the Radiation Surface Science and Engineering Laboratory at the University of Illinois at Urbana-Champaign. IGNIS (Ion-Gas-Neutral Interactions with Surfaces) is a state-of-the-art *in-situ* experimental surface science facility capable of characterizing surface materials under extreme conditions.

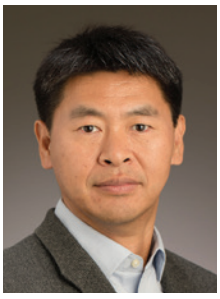
Allain and Zhang will use facilities at the National Institute of Standards and Technology in Gaithersburg, Maryland, for the neutron phase.

The U.S. Department of Energy Fusion Energy Sciences division supports the research.

For more details, go to go.npre.illinois.edu/fusionreactormaterialsstudy.

Radiological Applications

IMAGING TECHNIQUES TO MAP METAL-CONTAINING THERAPEUTIC AGENTS



A $2 million National Institutes of Health grant will support Prof. Ling-Jian Meng's group in developing X-ray Fluorescence Emission Tomography (XFET) imaging techniques to map metal-based compounds used to enhance radiation therapy in cancer treatment.

Meng's group will develop an ultrahigh sensitivity, broadband X-ray fluorescence emission tomography (XFET) system. The facility will combine advanced semiconductor imaging spectrometers assembled in a customized single-photon emission computed tomography (SPECT)-inspired detection system with optimized source/filtering configurations.

Potentially, nanoparticles containing metals may improve cancer therapy by enhancing cancer-specific X-ray absorption and generating radio-dynamic effects targeting cancer cells.

For more details, go to go.npre.illinois.edu/meng_NIH-grant.

IMAGING SCANNER TO BE DESIGNED FOR HEAD AND NECK CANCER

Assistant Prof. Shiva Abbaszadeh's research to develop a high spatial resolution imaging scanner that will assist doctors treating head and neck cancer patients has gained a $2 million National Institutes of Health award.

Abbaszadeh, an expert in radiation detection, proposes a device that will accurately determine the extent of the disease, detect smaller lymph nodes, and assess cancer recurrence earlier.

"Current head and neck cancer diagnosis and treatment planning suffers from poor spatial resolution of whole-body positron emission tomography (WB-PET) scans," Abbaszadeh said. "In this project, we seek to address this problem by translating high resolution radiation detection technology to head and neck imaging."

For more details on this story, go to go.npre.illinois.edu/abbaszadeh_head_neck_cancer.

Undergrads find value in research experiences

Jazz Kroeger's LinkedIn page tells the world how much he valued his undergraduate research experience in NPRE.

"The most experience I got was being involved in research," wrote Kroeger, a December graduate. "This allowed me to develop skills like making a program to process signals from a medical imaging device and produce images. Additionally, I was able to get better at public speaking skills when presenting that material in a poster."

Kroeger, who is pursuing medical school, found numerous project opportunities, and wound up working with two NPRE groups, those of Prof. Ling-Jian Meng and Prof. Clair Sullivan. Meng develops radiological imaging devices and Sullivan, who has since left the university, worked in radiation detection.

Currently, half of NPRE's 125 undergraduates participate in research. Department Head Rizwan Uddin would like to see that expand to all NPRE's undergrads. "Such opportunities enhance what the students learn here, add to their qualifications for future jobs, and gives them a glimpse of what they might expect as graduate students. We would like to be able to offer a research experience to any NPRE undergrad who wants to take it."

Current NPRE graduate student Dhruval Patel, who earned an NPRE bachelor's degree in December, also conducted research in the Center for Plasma-Material Interactions to acquaint himself with the department. "I just wanted to learn more about the major in general; I figured the easiest way to do so would be to work on any available projects," Patel said. "I was lucky enough to be a part of three different research teams over a period of two and a half years."

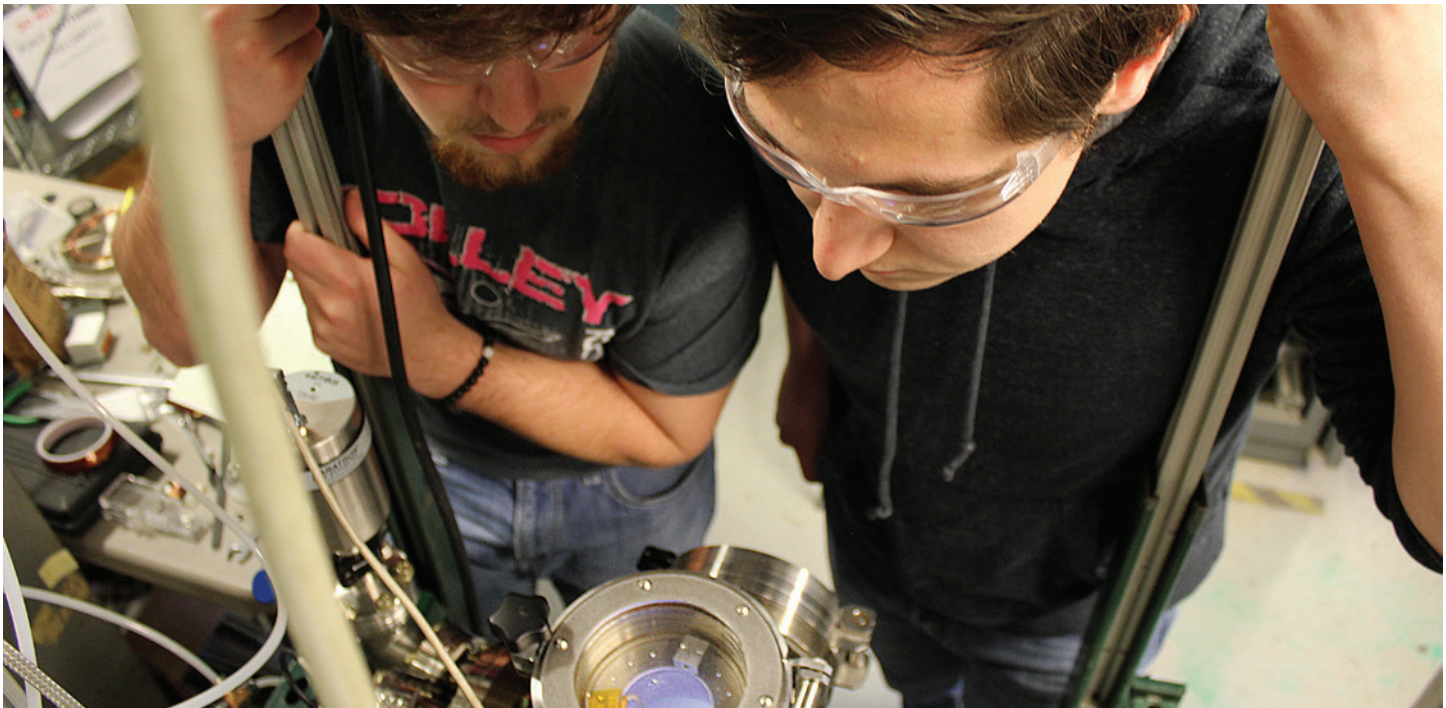
Patel found that assisting in research helped him better absorb classroom lessons. "One of the reasons I was able to keep up with the dense material presented was because I was able to draw from my research experience. In addition, conversing with the graduate students can often give you a different perspective to a problem than one presented in classrooms. This can sometimes give you a better grasp of the class material."

Another benefit is the possibility of being published as an undergrad. Case in point has been Daniel Johnson, an Engineering Physics and Computer Science major who worked with Research Assistant Prof. Daniel Andruczyk on the Hybrid Illinois Device for Research and Applications plasma/fusion facility. Their findings appeared in the March 2018 edition of *Fusion Engineering and Design*, and Johnson was listed as first-author for the paper.

Many undergraduates come to a greater realization of the importance of research experience as they make their ways through their academic careers. "Every undergrad in science should be involved in research," said Gregory Romanchek, currently an NPRE graduate student working with Prof. Shiva Abbaszadeh, an expert in developing biomedical imaging instrumentation. As an undergraduate majoring in Engineering Physics and NPRE at Illinois, Romanchek was involved in the Illinois Scholars for Undergraduate Research. "I did not fully understand what it meant to be a researcher until I worked as one," he said.

Patel seconded Romanchek's belief: "I cannot think of any other activity that has been this rewarding. You learn a lot everyday by interacting with the folks over in the research group. The whole idea is to get a peek at the possibilities that Illinois Engineering has to offer."

For more details on this story, go to go.npre.illinois.edu/undergraduate_research.



Faculty, students gain recognition

ROY AXFORD

Emeritus Prof. Roy A. Axford has been named a Fellow of the American Nuclear Society.

The 11,000-member organization reserves Fellow designation as its highest membership recognition. Axford was cited "for dedicating over 50 years to the pursuit of teaching excellence, for molding two generations of leaders in nuclear engineering education and research, and for instilling in his students the technical knowledge, ethical fortitude and social responsibility necessary for developing and maintaining this country's national nuclear security operations."

For more details, go to go.npre.illinois.edu/axford_ANSFellow.

JIM STUBBINS

The American Nuclear Society has honored James F. Stubbins, Donald Biggar Willett Professor in the College of Engineering, with the 2018 Arthur Holly Compton Award and the 2018 Landis Public Communication & Education Award.

The Compton Award recognizes outstanding contributions to education in the field of nuclear science and/or engineering. The Landis Award recognizes individuals who have significantly impacted public education and communication regarding the peaceful applications of nuclear technology.

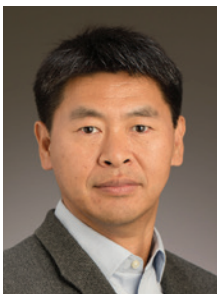
For more information, go to go.npre.illinois.edu/stubbins_landis-public-communication and go.npre.illinois.edu/stubbins_compton.

JP ALLAIN

Prof. JP Allain was selected for the 2018 Technical Accomplishment Award of the American Nuclear Society Fusion Energy Division (ANS FED).

Allain has been cited "for pioneering work on *in-situ* plasma-material interaction diagnostics and surface chemistry in nuclear fusion devices." He and his group designed the Materials Analysis Particle Probe (MAPP), an *in-vacuo, in-situ* characterization device that is attached to a fusion reactor to expose an ensemble of samples and characterize their surfaces in a shot-to-shot basis.

For more on this story, go to go.npre.illinois.edu/allain_fed-accomplishment-award.



LING-JIAN MENG

Prof. Ling-Jian Meng has been selected as the 2018 winner of the American Nuclear Society Radiation Science and Technology Award.

Meng, who has established within NPRE a world-premiere research group for developing radiation detection and imaging devices, has been cited for significant contributions to the field of radiological imaging, and their applications in healthcare, radiation detection, and nondestructive assessment.

For more on this story, go to go.npre.illinois.edu/meng_radsci-and-tech-award.

XIANG LIU

Xiang Liu, who earned his PhD in NPRE in May, is the 2018 winner of the American Nuclear Society Mark Mills Award.

The national award recognizes the graduate student author who submits the best original technical paper contributing to the advancement of science and engineering related to the atomic nucleus.

Liu focused his research on understanding how different types of irradiation affects the microstructural evolution in advanced reactor candidate alloys, and how these radiation-induced microstructural changes affect the material property.

For more on this story, go to go.npre.illinois.edu/liu_mark-mills.

DAVID RUZIC

Prof. David N. Ruzic has been elected to the grade of Senior Member in the International Society for Optics and Photonics (SPIE).

Serving more than 264,000 constituents internationally, SPIE's mission is to advance emerging, light-based technologies through information exchange, continuing education, publications, patent precedent, and career and professional growth. Ruzic's connection to SPIE has been through his research and development of EUV lithography.

For more on this story, go to go.npre.illinois.edu/ruzic_SPIE-senior-member.

RIZWAN UDDIN

Prof. Rizwan Uddin has been recognized with the 2018 University of Illinois at Urbana-Champaign Campus Award for Excellence in Graduate and Professional Teaching.

Uddin's impact in graduate teaching has resulted in three of his students being chosen as winners of the annual American Nuclear Society Mark Mills Award. The national competition recognizes the graduate student author who submits the best original technical paper contributing to the advancement of science and engineering related to the atomic nucleus.

For more on this story, go to go.npre.illinois.edu/uddin_campus_graduate-professional_teaching.

NATHAN REID

Graduate student Nathan Reid was awarded First Place for his research in the Nuclear Engineering Science Laboratory Synthesis (NESLS) program end-of-summer Poster Session at Oak Ridge National Laboratory (ORNL).

Reid won for his project, "Glow-Discharge Optical Emission Spectroscopy of Neutron-Irradiated Tungsten." He has been mentored the past two summers by ORNL research staff scientist Lauren Garrison, an NPRE alumnae. The work was performed as part of the U.S.–Japan PHENIX Cooperation Project on Technological Assessment of Plasma Facing Components for DEMO Fusion Reactors.

For more on this story, go to go.npre.illinois.edu/ORNL_poster-session-award.

ARIC TATE

The research of NPRE graduate student Aric Tate to add precision timing to a high-Z detection technique was recognized at a national-level nuclear security meeting.

Tate gained the Best Poster Award for his work, "Muon Tomography with Fast Timing for Fissile Material Detection," presented during the Defense Nuclear Nonproliferation Research & Development meeting held in June. Universities and laboratory partners from across the country were invited to showcase their research to the broader nuclear security and nonproliferation community.

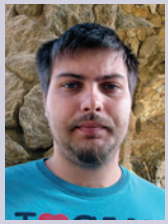
For more details, go to go.npre.illinois.edu/nuclear-security_poster_award.

ANS SCHOLARSHIPS

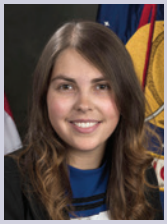
Three NPRE graduate students and two undergraduates have gained national scholarships from the American Nuclear Society.

NPRE Graduate students Anshuman Chaube of India and Andrei Rykhlevskii of Russia received John and Muriel Landis Scholarships. This is the second Landis Scholarship for Rykhlevskii.

Anshuman Chaube



Andrei Rykhlevskii



Carly Romnes

Graduate student Carly Romnes of Dulce, New Mexico, received a Michael Lineberry Graduate Scholarship.

Senior Jacob Tellez won the William R. and Mila Kimel Nuclear Engineering Scholarship, and Senior Alyssa Hayes won the John R. Lamarsh Memorial Scholarship.

For more on this story, go to go.npre.illinois.edu/ANS_scholarships.

Jacob Tellez

Alyssa Hayes

Alumni Honors

2018 NPRE DISTINGUISHED ALUMNUS

Craig A. Laughton's inventiveness and entrepreneurial spirit has led to technology affecting the lives of over 100,000 cancer patients each day.

Laughton, the 2018 winner of the NPRE Distinguished Alumni Award, is co-founder and Chief Executive Officer of Lifeline Software, Inc. The company has developed RadCalc®, a software program that provides fully automated independent dosimetric validation calculations for conventional, intensity-modulated radiation therapy (IMRT), and volumetric modulated arc treatment (VMAT) planning systems.

RadCalc® now is used in over 2,200 clinics around the world, and over 1,600 in the United States, alone. It was the first software to introduce an IMRT solution and the first to provide a quality assurance software solution for VMAT treatment plans. It furthermore was the first to provide 3-dimensional validation for Brachytherapy treatments.

Laughton, of Hinsdale, Illinois, earned bachelor's and master's degrees from NPRE in 1990 and 1992, respectively. He went on to study medical physics at the University of Chicago, earning a master's there in 1994. After working a couple of years at the University of Chicago Hospital, Laughton took a position as an assistant medical physicist at East Texas Medical Center in Tyler, Texas in 1996. He and his partner co-founded Lifeline Software in 1999.

For over 20 years, Laughton has generously supported NPRE programs, including student scholarships and fellowships. He serves on NPRE's Constituent Alumni and Industry Advisory Board.

See a profile on Craig Laughton, go.npre.illinois.edu/Craig_Laughton.

COLLEGE RECOGNIZES ZEDIKER, KOTEK

Two NPRE alumni have gained the 2018 College of Engineering Alumni Award for Distinguished Service: Mark Zediker, for entrepreneurial acumen, and John Kotek, for shaping U.S. nuclear power policy.

Zediker was recognized *"for invention of the world's first industrial semiconductor laser, for pioneering contributions to the design and development of high-power laser systems for commercial applications ranging from materials processing to manufacturing to mining, and for entrepreneurial leadership that has fostered technology transfer and economic development in the United States."*

In 1998, Zediker started his first laser company, Nuvonyx, Inc., a provider of high-power laser diode components, arrays, and industrial laser systems for materials processing and defense applications. Nuvonyx, Inc. had 100 percent revenue growth annually over a five-year period. The prosperity of the organization led to the sale of two divisions: Nuvonyx Europe to Quantel and Nuvonyx to Coherent.

In 2009, Zediker started Foro Energy, which commercializes the application of high-power lasers for the oil, natural gas, geothermal, and mining industries. In 2010, Zediker's team received a $9.1 million Department of Energy Advanced Research Projects Agency-Energy grant to develop a high-power laser drilling system for geothermal applications.

In 2015, Zediker founded NUBURU, Inc., his third company. NUBURU developed the first-to-market class of high-power, high-performance blue lasers that led the transformation to a world of high-speed, high-quality metal machining and processing. The AO-150 is NUBURU's first product, and it is a finalist for this year's PRISM Award because of its advancement in using visible lasers for welding.

Kotek was cited *"for his dedication in shaping U.S. energy policy, and for his steadfast advocacy of the responsible use of nuclear power."*

As the vice president for policy development and public affairs at the Nuclear Energy Institute (NEI), Kotek is responsible for providing policy and public affairs leadership on financial, economic, tax, electricity market, and environmental issues related to the nuclear energy industry.

Kotek has been working with federal agencies and laboratories throughout his career. In 2007, Kotek became the managing partner of the Gallatin Public Affairs office in Boise, Idaho. He advised energy, natural resources, and other clients facing complex communication and government relations challenges. During this time, from 2010-2012, he served as staff director to the Blue Ribbon Commission on America's Nuclear Future, which recommended a new strategy for managing nuclear waste in the United States. And in 2012, Kotek was named to the Governor of Idaho's Leadership in Nuclear Energy Commission.

In January 2015, Kotek was appointed to the position of principal deputy assistant secretary for the Department of Energy Office of Nuclear Energy. Later that year, in October 2015, President Barack Obama appointed Kotek to serve as assistant secretary for nuclear energy, which is the country's top nuclear energy office. In 2017, he was honored with the NPRE Distinguished Alumni Award.

For more details, go to go.npre.illinois.edu/distinguished_zediker_kotek.

MASTER OF ENGINEERING IN ENERGY SYSTEMS

Energy Systems program continues growth

Momentum continues to build for the Master of Engineering in Energy Systems degree, created to provide a broad interdisciplinary education in energy systems for a variety of professional career-track students.

In its fifth year starting in January, the program has grown to an enrollment of 30 students. Energy Systems counts 38 alumni, with 10 more students scheduled to graduate in December.

NPRE administers the program within the College of Engineering.

Twenty-eight organizations have hired Energy Systems graduates, including such companies as Tesla Motors, General Electric, Invenergy and Environmental.

The College of Engineering continues to find new means of enhancing its Master of Engineering programs such as Energy Systems, including the establishment of the Center for Professional and Executive Training and Education. The Center provides additional resources and support to the College's professional master's degree programs, including a dedicated Master of Engineering Career Service Coordinator, Internship and Capstone Projects Coordinator, and seminars and events designed specifically for professional master's degree students.

For more details on the Energy Systems degree, go to energysystemsmeng.engineering.illinois.edu/.

Brad Radl selected for 2018 NPRE Advocate Award

The way that energy is produced won't look the same in 20 years. The dynamics are both challenging and exhilarating, believes 2018 NPRE Advocate Award winner Bradley J. Radl.

Foreseeing the energy industry's growth and transformation, Radl created the Taber International Scholars program in the Master of Engineering Energy Systems degree that NPRE administers. Several students pursuing the degree have benefited from being named Taber Scholars and are on their way to shaping energy's future.

Radl's initiative and his service on the NPRE Constituent Alumni and Industry Advisory Board have led to his being chosen for the Advocate Award, which recognizes alumni and friends who have demonstrated their loyalty to NPRE through volunteer efforts, financial contributions, and/or other forms of advocacy.

Radl, BS 80, is Managing Partner and Chief Technology Officer for Taber International, LLC, and Griffin Open Systems, LLC, in Chardon, Ohio. He has worked in the energy industry for 35 years and has been recognized by the U.S. Department of Energy for his work on improving efficiency and reducing environmental impacts of energy production.

"There is, and will continue to be in the near future, tremendous opportunity for invention and innovation that can alter how the world is powered."

Radl has parlayed the knowledge he gained at NPRE in the areas of physics, systems design and analysis, and teamwork to solving problems in the area of real-time control of complex problems. He has used this engineering skill set in a range of energy production facilities including nuclear, fossil and renewable energy.

For a profile of Brad Radl, go to go.npre.illinois.edu/radl_NPRE-advocate.

Energy Systems degree key in Taber Scholars' career plans

Taber International Scholars Connor Daly and Joe Darga want to tackle issues of climate change and sustainability. Taber Scholar Emmanuel Fadahunsi hopes to broaden his knowledge and impact as an energy-focused professional.

All three are pursuing a Master of Engineering in Energy Systems degree at Illinois as a means for achieving their goals. The flexible and interdisciplinary curriculum provides a broad education in energy systems that prepares students for a variety of career options. The program includes gaining experience through an internship or by conducting an energy systems design project.

Connor Daly

"Climate change will likely be the largest engineering and societal problem for my generation, so I wanted to help solve it," said Daly, who concentrated on energy while earning a bachelor's degree in mechanical engineering in 2017 from Michigan State University. Daly is working on a project to improve the internal structural design of wind turbine blades.

"Once I earn the degree I want to get a full-time position working on wind turbine design and really make an impact on the cost of wind energy," he continued.

Daly considered energy programs at other universities, including Stanford, the University of Australia, Carnegie Mellon, and Cal Berkley. "I chose Illinois because the program allowed me to choose my specialty and allowed me to focus on renewable energy generation," he said. "I also liked that the out-of-state tuition was very reasonable comparatively."

Joe Darga

A 2017 Illinois alumnus, Darga holds bachelor's degrees in engineering physics and in applied mathematics and chemistry. The Energy Systems degree's flexibility has allowed Darga to construct his own program of study.

"For part of my degree, my project consists of professional coursework (TE 566—Finance for Engineering Management, TE 460-Engineering Entrepreneurship)," he said. "I decided to do the coursework option to leave time for additional research outside of the project requirements, with the outside research giving me the possibility to better segue this degree into a potential PhD if I choose to continue my education. The coursework I chose will provide useful insight and development if I do not choose that route.

"I hope to work in researching and developing photovoltaic materials, specifically quantum dots," Darga continued.

Darga had considered another energy program at the University of Michigan in Ann Arbor. "I ultimately chose UIUC because it was much more cost effective, better geared towards my interests, and much more interdisciplinary," he said.

Emmanuel Fadahunsi

"I believe the program will put me on track to become one of the future energy leaders who will shape the global sustainable energy future," Fadahunsi said.

He chose the Illinois program over a comparable program at the University of Michigan. "I chose Illinois because of the flexibility of its curriculum and the relatively shorter time to complete the program, which implies a lower cost."

Fadahunsi earned a bachelor's degree in mechanical engineering from the University of Lagos, Nigeria, in 2011. He spent five years working as a design/production engineer at a diesel generator manufacturing company and later as an operations engineer at a thermal power plant.

Upon completing his degree, Fadahunsi wants to work in industry as an energy consultant or manager. "I hope to use the expertise I'm developing in the field of energy and sustainability to help governments, corporations, businesses, non-governmental organizations, educational institutions and homes to meet their energy and sustainability goals."

M.Eng. in Energy Systems

meng-es@illinois.edu
(217) 300-2378

400 Engineering Hall, MC-266
1308 West Green Street
Urbana, IL 61801

High school students experience nuclear engineering at the new Exploring NPRE Camp

Eighteen high school students learned about plasma and radiological engineering as well as nuclear engineering during the first Exploring NPRE summer camp held in June. The students, currently high school juniors and seniors predominantly from the Chicago area, also learned what it might be like to be an engineering student at the University of Illinois.

High school students are commonly not exposed to nuclear engineering unless their chemistry or physics teachers touch upon it, said Becky Meline, NPRE Coordinator of Academic Programs who coordinated the camp.

"We wanted to make them aware of what nuclear engineering is and all of the different applications, because even if they've heard of nuclear engineering, sometimes they think only about nuclear power generation or stereotypes about nuclear power. But there are also a lot of other applications that they may not be aware of," Meline said.

Throughout the week, NPRE faculty and their research groups led sessions comprised of lectures, demonstrations, tours, and hands-on activities related to NPRE's diverse research areas.

Campers built light detectors, or sensors, using Arduinos. They learned about radiation, shielding, and half-life.

Another activity addressed nuclear medicine, such as the use of radioactive tracers, as well as radiology and imaging modalities, including PET and CT. Another activity explored the ways plasma and radiation can modify material surfaces. The camp also gave high schoolers the chance to design and build their own personalized game using Unity, a well-known game designing software.

The camp also featured several tours:

- Armed with Gamma-Ray detectors, the campers took a tour of campus to determine radiation levels of various locations.
- Participants toured the National Center for Supercomputing Applications 3D animation resources, and the Materials Research Lab.
- Campers visited the Exelon Clinton Power Station.

Said Meline of NPRE's goal with the camp: "It'd be great to have students say that they want to apply not just to the College of Engineering, but to NPRE directly. But even if they don't, they leave with a more educated understanding of what the area is about, and that's a good thing as well."

For more on this story, go to www.istem.illinois.edu/news/wyse.15.html.

HUFF PODCAST

Some people would describe nuclear power as "a very fancy way to boil water," Dr. Katy Huff remarked in an YesCollege.com podcast. Huff, an assistant professor of Nuclear, Plasma, and Radiological Engineering (NPRE) at the University of Illinois at Urbana-Champaign, touched on subjects that included

- why she was attracted to nuclear engineering,
- how nuclear power plants produce electricity,
- what the NPRE Department has to offer students,
- and what careers are available for nuclear engineers.

The complete interview is available at yescollege.com/episode/kathryn-huff/ .

Korean visitors explore collaboration with NPRE faculty

Scientists from the Korea Atomic Energy Research Institute (KAERI), Argonne National Laboratory and Purdue University joined Nuclear, Plasma, and Radiological Engineering faculty on the Urbana campus in the spring to discuss cooperation on nuclear reactor safety research and development.

Five Korean researchers joined their colleague, Dr. Chul-Hwa Song, who is working within NPRE this year as an Adjunct Research Professor and who helped organize the Workshop on Nuclear Reactor Safety held in March. The workshop was intended to exchange information on nuclear power safety research and development, mainly focusing on thermal hydraulic and severe accidents research and development, for establishing and practically launching the bilateral cooperation between THSARD and NPRE.

For more details on this story, go to go.npre.illinois.edu/KAERI.

GIVING BACK

Investment in NPRE Visionary Scholarships grow, providing much-needed student support

Since The Grainger Foundation Matching Challenge for scholarships was announced in Spring 2017, NPRE Visionary Scholarship funds have reached $693,000, and continue to grow!

The credit for this outstanding response goes to NPRE alumni and friends, including Exelon Corporation, which has established the Exelon-NPRE Visionary Scholarship. The company's $250,000 investment for undergraduate students was matched by the Grainger challenge.

Making this campaign especially attractive is The Grainger Foundation's promise to double the impact of scholarships by matching gifts dollar-for-dollar through the end of 2019. "This is the perfect time to double or even triple the power of someone's gift to the department and impact the lives of our students," said Ross Williams, Assistant Director of Advancement.

NPRE notes that Chicago-based utility giant Exelon has generously invested in the department's students for more than 20 years. The company's support has enriched the educational experience in NPRE, and many Illinois alumni have gone on to work for the company in the nuclear power field.

In addition to providing financial support, Exelon has consistently awarded NPRE students internships, and participated in job fairs, including NPRE's own SPEED-Interchange event. For 10 years, SPEED-Interchange has invited representatives to share their company's information with students and offer them career advice.

For more on the Exelon-NPRE Visionary Scholarship, go to go.npre.illinois.edu/exelon_npre_vs.

Mother's courage paves way for son's success

Phi L. Nguyen, BS 88, MS 90, Vice President of Technology and Manufacturing at Intel Corp., has created within NPRE the Nguyen Thi Cuong Fellowship to honor his mother. In the following story, Nguyen recalls his mother, a truly remarkable woman, and their incredible journey together.

As a child, Nguyen Thi Cuong and her family were forced to move from North to South Vietnam because of the civil war. Three decades later, she coordinated with undaunted courage what her son, Phi L. Nguyen, still thinks was a miracle: She was solely responsible for her family's and her sister's family's escape to the United States—with no money and not knowing a single word of English. This is the story of Nguyen Thi Cuong, an amazing woman for whom Phi has named a Fellowship in NPRE.

Phi, his younger brother, his mom and his dad were what history later labeled the "Boat People"—they were among the 2 million South Vietnamese who fled the country by any means possible between 1975 to 1995. More than half those refugees died, facing dangers from pirates, over-crowded boats, and storms. Phi and his family were lucky—they survived.

Though suffering hardships including hunger at that time, Phi was a young boy and didn't remember being frightened. To him, it was an adventure. But his mother realized the perils that faced them—she had lived them before. When she was just 10, her family escaped from North to South Vietnam as the French lost control of the North and the Communists took over. Twenty-nine years later, as their capital of Saigon was under siege, Thi Cuong, the wife of a South Vietnamese soldier, feared what was coming. "They both knew that if (my dad) were to stay he would have been executed. And we would have been sent to an 'educational' facility," Phi said. Many people endured torture, starvation, and disease while being forced to perform hard labor at those facilities.

So Thi Cuong orchestrated the family's getaway. She arranged for passage on a wharf for her own family and that of her sister, her sister's husband, and their six children. Phi's family left behind almost everything, taking with them only one army duffel bag filled with clothing. They joined about half a dozen other families on the "floating box," with its walls of mesh fence filled with sandbags, and left shore on April 29, 1975, the day before the official Fall of Saigon.

But the captain of the tugboat pulling their wharf had second thoughts about wasting his fuel to save just a few families.

He cut the rope pulling them, and they drifted back towards Vietnam. As they returned, the vast exodus—a sea of ships exiting and thousands of panicked people clamoring at the shoreline for rescue—imprinted on Phi's memory. "Within hours our wharf was jam-packed," he recalled. One of those who came on board was a priest carrying a shortwave radio and enough gold to convince another tugboat to pull their craft out to sea, towards the Philippines.

Realizing not enough food or water was on board to sustain all the refugees, the U.S. sent cargo ships on mercy missions to intercept boats like the one carrying Phi's family. A cargo ship arrived at their wharf about a week after they left shore. As the wharf's passengers attempted to board the cargo ship, they collapsed the wharf's walls. Many people died as the two vessels banged together, Phi remembered.

The cargo ship couldn't carry all the passengers, so Phi, his brother and his mom were boarded but separated from his dad and his aunt, uncle, and cousins. Phi and his mom and brother were processed in the Philippines then were sent on to a military camp on Wake Island for about three weeks.

"Every day my mom would go to the American office to see the names of the people processed," Phi recalled. "On Wake, one of my jobs was to get food from the Army. Every day, the food was being handed out and I would bring it back. One of the times, I was standing in line and I saw my little cousin. I asked her, 'Where's your family?' She was there by herself. She was 8. I asked her, 'What happened?' She said her mom had given her to somebody, to one of the families that was going on the cargo ship.

"Everything you've seen in the movies, I saw it there with my family," Phi continued. "Parents would literally hand over their children to strangers in hopes of giving their children a chance to be alive and living in the US."

A week later, he found another cousin who had gone through the same experience in getting to Wake. She was just 7. Phi took both the girls back to his mother.

While caring for now four children, Thi Cuong watched the Army's processing of refugees anxiously. "One day, she came

"No matter what life threw at her, she found a way. And so when I have a hard day at Intel, it's a no-brainer."

home so excited—smiling and crying. She had found my dad's name," Phi recalled. Thi Cuong then got to work convincing the Americans to send herself and the children to Guam. There they reunited with Phi's dad and aunt and uncle and the other children, who had been rescued by a second cargo ship. "I remember them hugging, and remember my aunt totally freaking out. Here were her two daughters that she thought she'd never see again," Phi recalled.

After about a week in Guam, the family was transferred to Fort Chaffee, Arkansas, until they could gain an American sponsor. The Skrogstad family and the Catholic Church helped find a home for them in Rock Falls, Illinois. Although she knew no English, Thi Cuong found a way to communicate with her sponsors and those in the community to gain jobs. Having served as a village doctor in South Vietnam, Thi Cuong found work in a nursing home. Phi's dad gained work as a janitor in a steel mill. Phi and his brother were placed in Catholic schools.

RABEL RIZKALLAH NAMED FIRST CUONG FELLOW

Rabel E. Rizkallah, the inaugural Nguyen Thi Cuong Fellow, has spent the past two years in the Center for Plasma-Material Interactions helping to prepare the HIDRA plasma/fusion facility for operational status.

"I recently finished characterizing the HIDRA plasma by taking flux surface measurements and comparing them to my simulations from computational methods," Rizkallah said. "Now, we are opening HIDRA to install one of the plasma-facing components with the plan to run experiments on it all the way through December."

Advised by Research Assistant Prof. Daniel Andruczyk who directs HIDRA's operations, Rizkallah focuses his research on designing and developing liquid lithium-based plasma-facing components to be used within fusion devices.

Rizkallah earned bachelor's degrees in mechanical engineering and physics in 2015 and 2016, respectively, from Notre Dame University Louaize in Zouk Mosbeh, Lebanon.

In South Vietnamese culture, a woman was expected to be submissive. Thi Cuong frequently stepped outside that role for the sake of her family's survival. In their new country, she continued to do so, with an eye toward seeing them thrive.

Without knowing the language, she convinced another American family to sponsor Phi's aunt's family. Thi Cuong enrolled in a Sauk Valley Community College migrant program to learn English, which she accomplished in two years. She left the nursing home for a higher-paying factory job, working there until Phi graduated from college. And instead of moving to a larger city where whole communities of Vietnamese refugees had settled, Thi Cuong insisted the family stay in their small town and immerse themselves in their environment. She realized that, in order to be successful in a new country, the family must become a part of it.

"Most refugees go to a big city, we didn't … we immersed," Phi said. "We also had a great balance of Vietnamese culture, as well. Looking back, it was definitely a huge sacrificial thing for my mother to do, because it's lonely in the middle of the corn field when there's only yours and your sister's family.

"We could have easily gone to Chicago, but we didn't because my mom knew that I would have the Vietnamese culture at home from her and my father," Phi explained. "For some reason, my mom had this foresight—we had to know what homecoming was, we had to know what football was, we had to know what hot dogs and baseball meant. She forced me to play basketball."

And, with a combined salary of just $30,000 annually at the top of their earning years, Phi's parents managed to put both their sons through the University of Illinois at Urbana-Champaign. Phi gained a Pell grant, and worked 20-25 hours a week in a work-study program to help meet costs.

Now, as Vice President at Intel Corporation, Phi heads the research and development work of about 400 Intel engineers, many of them PhDs. And he continues to say "thank you" to the one who most influenced his success: the new fellowship fund he has created in NPRE bears the name Nguyen Thi Cuong.

"No matter what life threw at her, she found a way," Phi remarked, in appreciation. "And so when I have a hard day at Intel, it's a no-brainer.

"My mother has always put family and helping others above herself. This fellowship will help financially disadvantaged students for as long as the University will be around—just as she would like it to be."

See this story on our website: go.npre.illinois.edu/Nguyen_Thi_Cuong_Fellowship.

ILLINOIS

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