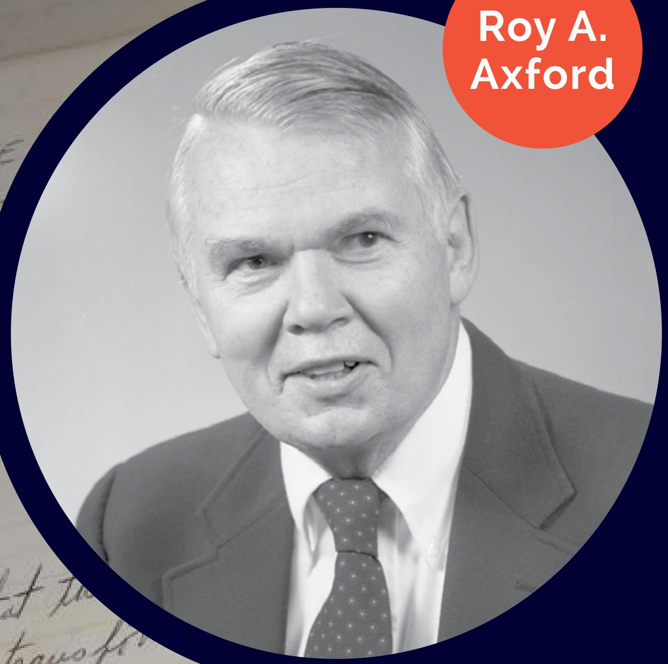
NPRE ILLINOIS
DEPARTMENT OF NUCLEAR, PLASMA, AND RADIOLOGICAL ENGINEERING

FALL 2017
NEWSLETTER FOR ALUMNI & FRIENDS

In appreciation of 51 Years of Teaching, Mentoring and Research



Roy A. Axford

5 **Rizwan Uddin** named NPRE Department Head

7 **HIDRA** achieves full operability

28 Faculty, students, alumni gain **national recognition**

44 Double your investment with **NPRE EVS!**

DEPARTMENT OF
NUCLEAR, PLASMA, AND RADIOLOGICAL ENGINEERING

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

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 | assistant professor

Jont Allen | affiliate faculty

Michael Aref | adjunct assistant professor

Roy A. Axford | professor emeritus

Robert S. Averback | affiliate faculty (emeritus)

Jeffrey L. Binder | adjunct assistant professor

Stephen A. Boppart | affiliate faculty

Thomas J. Dolan | adjunct professor

J. Gary Eden | affiliate faculty

Masab H. Garada | adjunct assistant professor

Barclay G. Jones | professor emeritus

Brian E. Jurczyk | adjunct research assistant professor

Michael D. Kaminski | adjunct associate professor

Kyekyoon Kim | affiliate faculty

Susan M. Larson | affiliate faculty

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

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Clifford E. Singer | professor emeritus

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ILLINOIS

NPRE TEACHERS RANKED AS EXCELLENT BY THEIR STUDENTS

Fall 2016

Davide Curreli

Kathryn D. Huff

William R. Roy

David N. Ruzic

Rizwan Uddin

Spring 2017

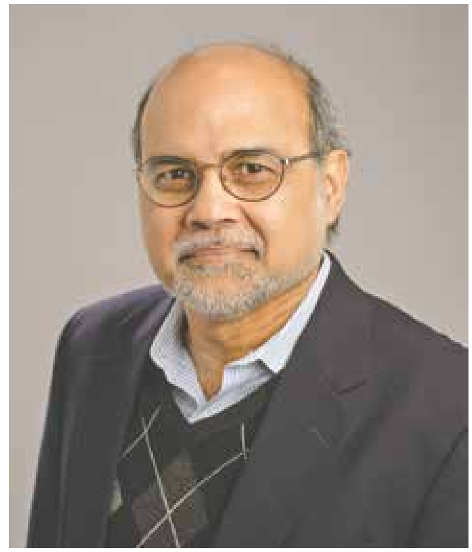
Caleb S. Brooks

Richard L. Holm

William R. Roy

Yang Zhang

James F. Stubbins



Rizwan Uddin

Dear Friends,

It has been a privilege to serve as NPRE Department Head for the past 18½ years. The time has seemed to pass very quickly. However, over that period we have completely transformed the Department while continuing our commitment to the highest standards of education and research. We have been extremely fortunate to attract to our undergraduate and graduate programs the very best students, many of whom have gone on to great accomplishments. I have been equally fortunate to have the support of our exceptional faculty members, and together we have developed into a much more diverse and a much stronger Department. Of course, this was a community effort and I would like to thank our faculty and staff for their commitment to building a strong, cooperative culture of excellence in NPRE. All of this has been reflected in the advances we have shared with you in our annual newsletters over the years.

During this past year we have taken another important step forward by naming a new Department Head. In this process, I was gratified to see all of our senior faculty step up for consideration for the position, all with productive thoughts of how we could improve and grow. I'm sure that the thoughts and discussions surrounding the selection process will continue to play an important part in developing our future strengths.

I am equally certain that Prof. Rizwan Uddin, in his new role as Department Head, will provide the leadership and

> "We have completely transformed the Department while continuing our commitment to the highest standards of education and research."

guidance for us to move well beyond our current stature. I have had the true pleasure of working with him most directly on departmental issues in his role as Associate Head for the past several years. I knew of his considerable capabilities for a long time, but it took a while to convince him to assume the position as Associate Head. This experience has certainly prepared him to put in place the vision he shared in the selection process. And I know he is more than capable of bringing the Department to a new level, one of which we will all be very proud. I am committed to supporting him in his efforts. I invite all of you to share in this quest to build an even stronger NPRE.

Sincerely,
James F. Stubbins

Dear Alumni and Friends,

As I consider my new responsibilities as Head of Nuclear, Plasma, and Radiological Engineering at Illinois, I think of how honored and privileged I am in being a part of this Department. NPRE has been my academic home both when I was a graduate student and throughout most of my professional life, so I am doubly invested in its growth and success.

I also think of what an excellent example of leadership I have had in Jim Stubbins. Jim has served NPRE for nearly 37 years, more than two-thirds of that time in leadership positions. Throughout his tenure, Jim has been a tireless defender and advocate for NPRE. As a result of his efforts, our undergraduate enrollment and graduate enrollment grew to historic heights. In addition to student numbers, our faculty numbers have doubled over the last seven years as the Department attracted the best young faculty to join us. These faculty members are already making their presence felt at the college, campus, national and international levels. Our faculty have received numerous national and international awards over the last several years, probably more than any other nuclear faculty over the same period. You will come to see, through the following pages, wonderful examples of innovation, impact, and service.

> “These faculty members are already making their presence felt at the college, campus, national and international levels.”

I get my inspiration from our faculty members, as well as our exceptional undergraduate and graduate students and dedicated alumni.

And, speaking of inspiration, I want to express my sincere gratitude for the more than half-century career of Prof. Roy Axford, who retired in August. I count myself among the students who have been inspired by Professor Axford’s incredible lecturing style, and his total mastery of the entire range of subjects covered by the curriculum.

As I consider my new role, I think of all the shoulders I am standing on, and all the giants we hope to shape for the future. It is an awesome responsibility, and I look forward to working with all our alumni and friends in advancing NPRE.

Sincerely,
Rizwan Uddin

Contents

GROWTH

5 Uddin named NPRE Department Head
5 Ruzic videos extend energy lessons to Illinois teachers, worldwide learners
6 Allain, Meng, promoted to full professor in NPRE; Kozlowski promoted to associate professor
7 Thorough preparations lead to fully operational HIDRA
8 NPRE researchers lead two new groups at Beckman

ENERGY SYSTEMS

10 Energy Systems offers 5-year degree program to earn combined bachelor’s and master’s of engineering
11 Taber Scholars find value in lessons from Energy Systems MEng degree
12 Recent Energy Systems graduate chosen to share research during 2017 iSEE Congress
13 Energy Systems team proposes additional charging stations to increase electric vehicle use on campus
14 Energy Systems spotlight: Shah

INNOVATION

15 Mohaghegh promotes Illinois’ leadership in socio-technical risk analysis
16 New discovery may lead to the development of super premium gasoline
16 NPRE researchers help prepare for future transport of spent nuclear fuel
17 NPRE researcher teams with Carle Hospital to improve quantitative accuracy in molecular imaging
18 DOE supports NPRE work to improve safety, longevity of nuclear reactors
19 Curreli’s computer modeling research gains DOE-SciDAC, NSF awards
21 Zircher’s virtual model reveals Engineering campus radiation levels
22 NPRE students gain valuable lessons from Nuclear Innovation Bootcamp experience
23 NPRE students develop startup to harness energy from spent nuclear fuel

IMPACT

24 NPRE pivotal in educational forum as Illinois vote saves two nuclear power plants
25 Prof. Roy Axford retires after 51 years of service to Illinois and the country
28 Zhang, Huff, gain ANS national recognition
29 Wet spent nuclear fuel storage project wins Hang Award
29 NPRE organizes IRRMA X conference
30 Campus honors Uddin with Excellence in Guiding Undergraduate Research Award
30 Allain recognized with Dean’s Award for Excellence in Research
31 ANS at Illinois honors Huff, Stubbins, as teacher and staff member of the year
32 Illinois student chapter earns ANS distinction for second consecutive year
32 Brooks garners Japan’s Atomic Energy Society promising researcher award
33 ANS at Illinois group shines at national student conference
34 Parsons combines plasma modeling with experimental work using HIDRA
34 Radaideh gains ORNL recognition for nuclear modeling and uncertainty quantification work
35 Cai awarded Beckman Institute Graduate Fellowship
35 Sakurahara receives Illinois Student Government’s Teaching Excellence Award
36 Fiflis wins college award for graduate student outstanding research
36 NPRE boasts two undergrads as 2017 Knights of St. Pat
37 Student excellence recognized
40 Engineering at Illinois Announces Barclay Jones as Distinguished Alumni Award Recipient
41 Schwartz is new Penn State Engineering Dean
41 Burchill honored with ANS Leadership Award
42 Hertel named Health Physics Society president-elect
42 Vodnik named to Crain’s Chicago Business Tech 50
42 Recent grad chosen as ANS national Student Director
43 2017 NPRE Distinguished Alumnus John Kotek presents NPRE Leadership Speaker Series talk

GIVING BACK

44 Double your impact through the new NPRE Visionary Scholarship Fund!
44 NPRE EVS Scholars
45 Why Do I Give?
46 Help support NPRE’s students and programs!

PARTING GLIMPSE

47 A chance to join Illini basketball rounds out college experience for NPRE freshman

Uddin named NPRE Department Head

Rizwan Uddin, professor of Nuclear, Plasma, and Radiological Engineering at Illinois, has been named the new NPRE Department Head.

"Rizwan assumes NPRE's leadership during a very exciting and opportune time for the department–its faculty has flourished with exceptional colleagues, whose expertise and research interest strengthened the department's disciplinary depth and interdisciplinary breadth," said Andreas Cangellaris, Dean of Engineering at Illinois.

"Rizwan is committed to their success and to NPRE's distinction as a top-ranked program," Cangellaris continued.

An NPRE alumnus, Uddin has distinguished himself as an educator and a scholar of international stature. He has made seminal research contributions in modeling and simulation of reactor engineering problems. His many and multidisciplinary contributions also include pioneering work in the use of 3D immersive, virtual reality systems and computer games for education and training in the nuclear field. He directs the Virtual Education and Research Laboratory in NPRE.

For over a year, Uddin has directed the Master of Engineering in Energy Systems Program and the Energy and Sustainability Engineering (EaSE) Council. He has served as NPRE's Associate Head of Academic Programs since 2013.

A Fellow of the American Nuclear Society, Uddin has been recognized with the 2016 ANS Arthur Holly Compton Award and the 2015 American Society of Engineering Education's Glenn Murphy Award for his teaching and research accomplishments. He was honored this spring with the Campus Award for Excellence in Guiding Undergraduate Research.

Uddin earned his master's degree and PhD in NPRE in 1983 and 1987, respectively. He earned a bachelor's degree in mechanical engineering in 1980 from the Middle East Technical University in Ankara, Turkey.

RUZIC VIDEOS EXTEND ENERGY LESSONS TO ILLINOIS TEACHERS, WORLDWIDE LEARNERS

David Ruzic, professor of Nuclear, Plasma, and Radiological Engineering at Illinois, brought his highly effective and engaging teaching style to a worldwide audience this past spring through Coursera's free Massive Open Online Course (MOOC) platform.

Working with the Center for Innovation in Teaching & Learning, Ruzic spent three years filming 130 videos under the title, *Energy, Environment and Everyday Life*. Each video is six to 10 minutes long and focuses on an energy-related topic, with material taken from Ruzic's popular Introduction to Energy Sources (NPRE 101) course. More recently, Ruzic has extended that effort, offering the series to all Illinois science teachers.

"We thought to ourselves, 'How could we make this more available to the public?' We did all this work; why not have it used?" he said. "I think this is a great public service."

The series first became available in April, through the MOOC platform. The University of Illinois has partnered with Coursera to promote the university's land-grant mission of sharing knowledge with people who are unable to physically come to campus. The effort also introduces the university to prospective students and lifelong learners across the globe.

Included in the videos are an overview of energy, chemistry, fuel cells, electricity and the electric grids, coal,

oil, natural gas, solar energy, wind energy, hydropower, nuclear energy, nuclear accidents (Chernobyl and Fukushima), nuclear waste, economics and fusion.

Allain, Meng, promoted to full professor in NPRE; Kozlowski promoted to associate professor

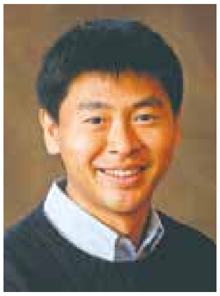
NPRE congratulates J.P. Allain and Ling-Jian Meng on their promotions to full professor, and Tomasz Kozlowski on his promotion to associate professor.

J.P. Allain

An NPRE alumnus, Allain joined the Department's faculty in 2013 as an associate professor. He came to NPRE from Purdue University where he had been a faculty member at the School of Nuclear Engineering since 2007, following four years as a staff scientist at Argonne National Laboratory. At Illinois, Allain is an affiliate faculty with the Department of Bioengineering, the Micro and Nanotechnology Laboratory, and the Beckman Institute for Advanced Science and Technology.

Allain is the author of over 170 papers, book chapters and proceedings in both experimental and computational modeling work in the area of particle-surface interactions. His research includes developing in-situ surface structure and composition evolution characterization of heterogeneous surfaces under low-energy irradiation promoting structure and function at the nanoscale.

Allain earned his master's degree and PhD in NPRE in 2000 and 2001, respectively. He earned a bachelor's degree in mechanical engineering from California State Polytechnic University in 1996.



Ling-Jian Meng

Meng joined the NPRE faculty as an assistant professor in 2006, following four years as an assistant research scientist and research fellow in the Department of Nuclear Engineering and Radiological Sciences at the University of Michigan. He also is an affiliate faculty member of the Department of Bioengineering at Illinois and the Beckman Institute. He is a visiting associate professor at the Massachusetts General Hospital and the Harvard Medical School.

The emphasis of Meng's research is to fundamentally advance the field of radiological sciences, especially to allow a more efficient use of ionizing radiation for healthcare applications. Over the past 10 years, Meng has been able to establish one of the most active research groups in the world in developing radiological imaging instrumentations.

Meng earned a PhD in physics from the University of Southampton in the United Kingdom in 2001, and a bachelor's degree in modern physics from the University of Science and Technology of China in 1995.

Tomasz Kozlowski

Kozlowski came to NPRE as an assistant professor in 2011, following two years as an assistant professor at the Nuclear Power Safety division of the Royal Institute of Technology in Stockholm, Sweden. He is a faculty affiliate of the Computational Science and Engineering Department at Illinois, was a visiting professor at the Warsaw Institute of Technology in Poland, and is an associate professor at the National Centre for Nuclear Research in Poland.

Kozlowski focuses his research on developing and validating advanced methods in deterministic safety analysis to accurately determine reactor safety margins and reactor behavior. His work supports nuclear reactor safety analysis, and increases the fidelity of primary system simulation.

Kozlowski investigates the capability and limitations of best-estimate coupled codes for reactor transient analysis, a complex problem involving the solution of thermal-hydraulics and neutron kinetics equations. While his initial focus was on coupled thermal-hydraulics and neutron-kinetic simulations of nuclear reactors and analysis of reactor transients and stability, the work has expanded to include fundamental mathematical, numerical and physical models problems in reactor simulation.

Kozlowski earned his bachelor's, master's and PhD in nuclear engineering at Purdue University in 2000, 2004, and 2005, respectively.

Thorough preparations lead to fully operational HIDRA

Eight months of careful preparations have led to success in now making the HIDRA plasma/fusion facility fully operational.

The facility, housed in the Center for Plasma-Material Interactions (CPMI), achieved first plasma in spring 2016, but was operating in low power mode until late July of this year.

“Even though we ran plasmas and had HIDRA running, we were not at full capability,” said NPRE Assistant Research Prof. Daniel Andruzyk, who directs HIDRA’s operations. “We had to commission the main power supplies, the rectifiers. The 20,000 volts that were coming in and the thousands of amps (for HIDRA) took a while to commission. We had to get (industrial applications firm) QuadPlus to come in with expertise to do this, and had to take our time to make sure that everything was in order.”

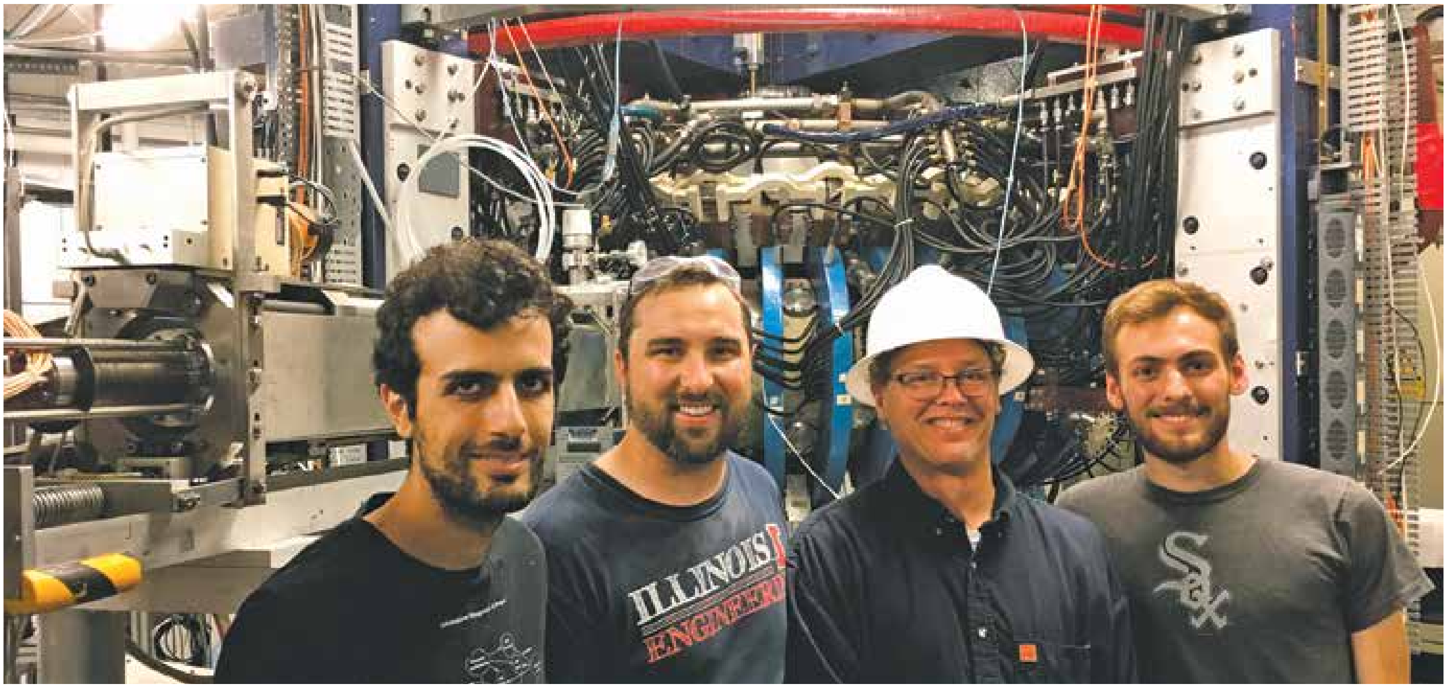
Combining capabilities of a tokamak and a stellarator, HIDRA provides scientists a valuable and unique testbed for plasma/fusion experimental research, the type of science that could one day lead to viable energy production from fusion reactors. HIDRA was transported from its original home at the Max Planck Institute for Plasma Physics (IPP) in Germany in 2014, and Andruczyk and his team have been very deliberate in reconstructing and safely restoring the facility to full functionality.

Since November, the team has been prepping CPMI’s headquarters in the Nuclear Radiations Laboratory to handle the substantial 2 million watts of power that will come in to the building to run HIDRA. “We had to make sure that the control system for this was up and running and make sure that we tested it and it was debugged,” Andruczyk said. “The 28th of July, we ran just the toroidal coils. Everything worked awesome; the control system worked beautifully! On Wednesday, August 2, we ran the helical coils and ran both (those and the toroidal coils) together. Everything works.”

HIDRA’s control system consists of a control panel and computer that operates water pumps and rectifiers, among other tasks. The entire system can be switched on and shut down immediately with a push of a button. “We have a computer control program in which we can put in any shape of plasma that we want,” Andruczyk said. “We shape the magnetic fields with the press of one button of the mouse; one person can run the whole machine, basically.”

Gaining full operability marks a tremendous milestone for HIDRA at Illinois. It was the goal of the first year of a 3-year, $1 million U.S. Department of Energy grant NPRE received in 2016 to support HIDRA’s work.

continued on page 9



NPRE researchers lead two new groups at Beckman

Two NPRE faculty members have extended the Department's impact on campus over the past year by establishing new working groups in the Beckman Institute for Advanced Science and Technology.

Rethinking the Role of Ionizing Radiation in Health Care

Prof. Ling-Jian Meng has created and is leading a new group to serve as an interface between radiological sciences, optical techniques, and nanomaterials. Meng believes the unique technologies the Radio-Opto-Nano Working Group will introduce will add to the far-reaching impact of the new University of Illinois College of Medicine.


Meng

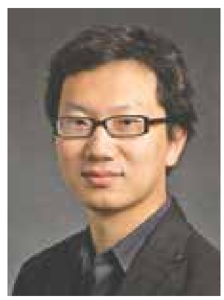
With prominent researchers and promising young scientists in chemistry, material science, bioengineering and biology, the group will combine penetrative ionizing radiation and radio-reactive nanomaterials to introduce precisely controlled physical, chemical and biological effects in deep tissue.

Together, their techniques will allow targeted therapeutic delivery and noninvasive manipulation of cellular, molecular and neural functions in living organisms, and potentially intervene in the progress of health issues including cancer, diabetes, and neurodegenerative diseases.

The underlying effort, says Meng, will be "to use radiation to manipulate cellular, molecular, and genetics of an organism's functions." Specific objectives are:

- Studying the use of penetrative ionizing radiation as a tool to perturb complex organisms such as cells, molecules and nanomaterials artificially introduced in deep tissue. Scientists then will develop experimental and theoretical approaches for understanding the cascade of physical, chemical and biological interactions, and how these interactions lead to imaging contrast and therapeutic effects.
- Developing and characterizing radio-reactive nanomaterials that could be used as imaging contrast, therapeutic agent, or as deeply embedded internal light sources that can be turned on and off at precisely controlled temporal and spatial patterns.
- Developing radiation-induced and nanoparticle-mediated approaches for therapeutic delivery, controlled drug release and noninvasive intervention of cellular, molecular and neural functions in deep tissue.
- Developing radiological and optical imaging techniques for studying the interactions of ionizing radiation with nanomaterials and for monitoring the therapeutic delivery processes.

In addition to Meng, members of the Radio-Opto-Nano group are Yang Zhang, NPRE; Jianjun Cheng, Materials Science and Engineering; Yi Lu, Chemistry; Dipanjan Pan, Bioengineering; Andrew M. Smith, Bioengineering; and Kai Zhang, School of Molecular and Cellular Biology.


Zhang

Computational Molecular Science Group Joins Beckman Institute Research Portfolio

Understanding various chemical reactions and transport phenomena from the molecular and electronic level; designing new synthetic pathways for radical forms of materials and medicines; characterizing and rationalizing the behavior of matter far away from equilibrium–these are just a few of the grand scientific and engineering challenges that the newest research group in Beckman aims to tackle.

By bringing together various research efforts across campus and leveraging outstanding resources at Illinois, such as the Computational Science and Engineering (CSE) program and the National Center for Supercomputing Applications (NCSA), the group plans to lead large-scale research efforts in the area of computational molecular science that would be beyond the capability of an individual research group.

The Computational Molecular Science (CMS) Group has been established within the Molecular and Electronic Nanostructures research theme at Beckman. Yang Zhang, NPRE assistant professor, is named the founding group leader.

Along with Zhang, the other nine faculty members of the group include Narayana Aluru, Mechanical Science and Engineering; Paul Braun, Andrew Ferguson, and Kenneth Schweizer, Materials Science and Engineering; Martin Gruebele, So

Hirata, and Nancy Makri, Chemistry; and Charles Schroeder and Charles Sing, Chemical and Biomolecular Engineering.

"Our goal is to consolidate campus-wide expertise on computational molecular science to facilitate interdisciplinary research in several strategic areas at the Beckman Institute and Illinois, and eventually establish a world-leading thrust in the frontier of theory-driven computational molecular science," said Zhang.

CMS is profoundly interdisciplinary. It embodies physics, which underpins the underlying fundamental principles; chemistry, which both explores higher-level emergent principles and creates novel synthetic routes of remarkable organic, inorganic, bio-molecular building blocks that can self-assemble to structures with unique properties; and molecular biology and medical science, which are imperative to improve our health and quality of life.

"This group is an intellectual powerhouse with ambitious aspirations to advance important problems in molecular design thinking. Their activities cut across a number of experimental projects in the institute and so, wisely, the new CMS group integrated key experimentalists into its faculty roster," said Beckman Institute Director Jeff Moore.

"The unique aspect of the CMS group is the emphasis of statistical and quantum mechanical theories-driven method development and applications," said Zhang. "Through these computations, our ambition is to significantly extend our understanding of the equilibrium and non-equilibrium properties of matter from the molecular and electronic level, along with the creation of simulation, visualization, and analysis software packages that would become the golden standards in the field of CMS."

The research topics of the CMS group include first-principle and semi-empirical methods, large-scale molecular dynamics simulations, advanced rare event sampling techniques, intelligent coarse graining and dimensionality reduction, and big data analysis—all targeted to advance molecular science. The impact of the work is amplified through close collaborations with experimentalists, synthetic chemists, materials scientists, and engineers.

The CMS group will synergistically collaborate with other groups, such as the Theoretical and Computational Biophysics and the Autonomous Materials Systems groups, at Beckman.

Thorough preparations lead to fully operational HIDRA, *continued from page 7*

Now collaborating researchers from Illinois and the Princeton Plasma Physics Laboratory (PPPL) will use HIDRA to test plasma-facing components the scientists propose using in the much larger Experimental Advanced Superconducting Tokomak (EAST) in Heifei, China. The combined work ideally will bring the world science community that much closer to developing commercial fusion energy reactors.

Thanks to the work of NPRE Prof. David Ruzic and his group in CPMI, Illinois is the world leader in liquid lithium technology for fusion reactors, Andruczyk said. The use of lithium as a PFC holds several advantages:

Lithium is a reactive, low-recycling material. As such, it absorbs impurities in plasma so that its temperature can rise more efficiently.

A liquid, lithium doesn't suffer damage the way a hard-metal surface would when plasma hits the reactor walls. "If you can flow the lithium at a sufficient rate, it should be able to handle more and more power coming out to the reactor wall," Andruczyk said. This durability should allow developers to shrink the size—and costs—of a fusion reactor.

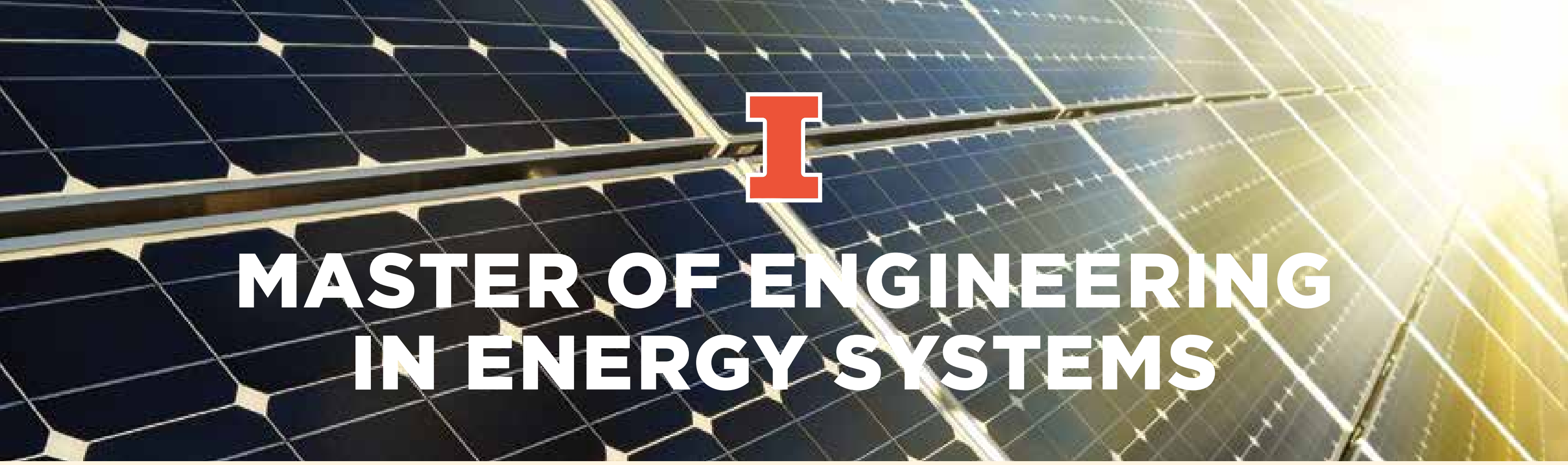
Ruzic's group has designed a method for molten lithium to self-circulate along the surface of a fusion reactor's diverter, where excess heat is collected and removed. The concept, known as LiMIT (Lithium/Metal Infused Trenches) will be tested in HIDRA, as well as PPPL's alternate design, FLiLi (Flowing Liquid Lithium Limiter).

"We want to see which design will work first—what would work better for one part of the reactor and what would be better for another," Andruczyk said. "We want to make sure both technologies are developed and perfected before they are put into EAST. We can find problems and fix kinks here (in HIDRA). It's easier to shut down HIDRA and change things around than it is on EAST. If they shut down, they have to shut down for six months; it's a big ordeal for them."

He added that many experiments tested on EAST might be adopted in the future to ITER, the first international fusion device to produce net energy. ITER is under construction in France, and its first plasma is expected in December 2025.

HIDRA will be available for other research at the same time the PFC experiments are conducted. For example, Andruczyk said he and NPRE Prof. J.P. Allain are using HIDRA for materials testing for a Small Business Technology Transfer grant that Allain holds. "We intend to have several things on the machine at the same time; we intend to make it a user facility," Andruczyk said. "One test won't interfere with another."

Andruczyk also has taught the course, NPRE 498 Fusion Device and Operations, in Fall 2015 and Fall 2016 using HIDRA and started an Introduction to Plasmas course in the spring of 2016.



MASTER OF ENGINEERING IN ENERGY SYSTEMS

Energy Systems offers 5-year degree program to earn combined bachelor's and master's of engineering

Beginning Fall 2017, juniors of several College of Engineering at Illinois departments can be admitted into a 5-year degree program that will culminate in a master's of engineering in Energy Systems.

The combined BS/MEng program will provide a smooth integration of the bachelor and master's studies, while providing the same breadth and depth of coverage for all the required courses of both existing degree programs.

Participating departments are Aerospace Engineering, Agricultural & Bioengineering, Industrial & Enterprise Systems Engineering, Material Science & Engineering, Physics, and Nuclear, Plasma, and Radiological Engineering. NPRE administers the Energy Systems program for Engineering at Illinois. Students must have at least one year left of their undergraduate program to be eligible to apply, and should apply in their junior year.

The College will identify qualified students early in their academic careers. It's expected the program's enrollment levels will rise by providing Engineering at Illinois students with an early introduction to Energy Systems.

The combined degree program will save students four credit hours that would be required if the degrees were pursued separately. "If the students plan beforehand, they can get the joint degree in less than what it would take otherwise," said NPRE Prof. Rizwan Uddin, who directs the Energy Systems program.

Students who enter the university as freshmen with several Advanced Placement credit hours conceivably could earn the two degrees in an even shorter period of time. "People who graduate in December (with a bachelor's) could do both degrees in one semester and a summer," Uddin said.

The Energy Systems program is designed to provide flexibility so that students can tailor their studies to the particular energy area that interests them.

Industry today demands engineers who possess a broad mix of math and science tools coupled with professional skills in communication, teamwork, and a *big picture* understanding of project management. Private firms, public agencies, and laboratories working toward modern energy solutions deal with multiple aspects of energy systems that require firm understanding of these concepts, as well as an ability to communicate with colleagues working across traditional disciplinary lines.

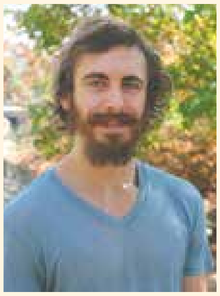
Typically, Energy Systems students can earn the professional, non-thesis, degree in one year or three semesters, choosing from a wide array of courses to specialize their concentration. The program requires an internship or energy systems design project to provide students with experience, and prepare them for leadership in their careers.

For more information, contact Amy McCullough at amccul2@illinois.edu or call 217-300-2378.

Taber Scholars find value in lessons from Energy Systems MEng degree

The Master of Engineering in Energy Systems degree at Illinois "is a very unique program tailored for individuals interested in understanding the *big picture* as it concerns all aspects of renewable."

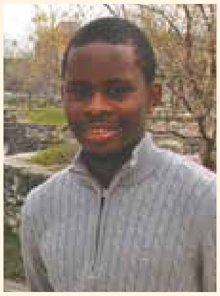
That assessment, from recent graduate Anthony Ekeopara, captures spot-on the intention of the program, which offers a diverse set of energy studies so students can chart the career paths that attract them individually. The Taber International, LLC, Scholarships, established by Brad Radl, an NPRE 1980 alumnus, has supported several students pursuing these paths.



Christopher Guida

Guida, the 2017 Taber Scholar, hopes the Energy System MEng will prepare him for a career in solar energy or bioenergy. "I am interested in working at the leading edge of sustainable technology to help create a healthier environment," he said. "I would like to work for the National Renewable Energy Lab, Tesla, or other industry leaders." He will finish the degree in December 2017.

Energy Systems graduate students complete a design project, internship, or professional development coursework as part of their degree requirements. Guida joined fellow Energy Systems students Adam Hijazi and Ari Krause in a project that promoted use of electrical vehicles on the Urbana campus by increasing the number of charging stations available.



Anthony Ekeopara

For his final project, Ekeopara, a 2015 Taber Scholar, studied a novel approach for improving yield, productivity and economic viability of biofuel production from algae. "It was challenging, but I learned a lot from it," Ekeopara said. "I learned that, with novel ideas and proactive policies, the challenge of climate change and reducing our carbon consumption and emissions is possible. Electric and bio fueled vehicles provide significant energy savings and reduced emissions as well. I also learned about the logistical challenges facing biofuel transportation."

Ekeopara earned the Energy Systems degree in December 2016. He now is working as a commissioning engineer to install and commission protection schemes, devices and electrical switch gear.

John Flanagan

Learning to collaborate with professors and university technicians was among the main lessons Flanagan, a May 2017 graduate, took away from his experience, along with design and construction scheduling, field experience and hands-on building experience.

For his project, Flanagan worked to design and build a thermal response test device to measure in-situ properties and study subsurface thermal dynamics to gain understanding and implementation of ground source heat pumps. "The project went so well that someone is moving on to the next phase of this effort as part of their MEng project," said Flanagan, a 2015 Taber Scholar.

The degree helped Flanagan secure his current position with the wind engineering team at a Chicago-based firm that develops wind farms, solar, thermal, and energy storage projects.

"The M.Eng. degree program gave me an opportunity to make a pivot in my career from project management to project engineering," he said. "Program directors and administrators were genuinely supportive of my pursuits; the coursework is challenging and rewarding. I would recommend this program to somebody passionate about seeking a career in fields related to energy and sustainability."

Kevin Kubis

Counted among the students Flanagan describes is Kevin Kubis, 2016 Taber Scholar. "Pursuing this degree was hands down, the best decision I have made in my life," he said. "The flexibility of the courses allowed me to learn special topic areas that I wish to pursue after college. These courses taught the overarching energy situation in the world and U.S., but also taught about different energy systems in great technical detail."

In addition to coursework, Kubis did a project for the Illinois State Geological Survey and Illinois Sustainable Technology Center in evaluating carbon capture and storage (CCS) feasibility in Central Illinois. "Overall, the project went incredibly well," he said. "CCS is a topic I wish to pursue in my career, and I feel that I am well-informed after performing this research. Coal-fired power plants have a vast potential to undergo capture retrofits and mitigate climate change, so adding research and awareness to the issue is something I am very proud of."

Having earned the MEng degree in May 2017, Kubis started working in September for the Downstream Offsites and Utilities Department of energy giant ExxonMobil.

Students interested in energy careers would find the Energy Systems degree very worthwhile, Kubis believes. "Pursue it, you definitely will not regret it! The world needs sustainable leaders to preserve our planet for future generations, and the first step to getting involved is to become educated with a degree like this!"

Recent Energy Systems graduate chosen to share research during 2017 iSEE Congress

Just a month after earning her master's of engineering in Energy Systems, Rashi Singh was selected among presenters for the 2017 Congress of the Institute for Sustainability, Energy, and Environment at the University of Illinois at Urbana-Champaign.

The 2017 iSEE Congress, held in September, assembled leading national and international scientists from various disciplines to advance understanding on the impacts of climate change on the agricultural sector, on ecosystem services, and on human livelihoods and wellbeing, particularly among the most vulnerable sections of society.

Singh presented "Solar DC microgrid models for rural communities," a study and analysis of the techno-environmental models of distributed DC-solar microgrids and centralized solar PV farms to determine their feasibility in the rural communities of Uttar Pradesh, India. "iSEE is a prestigious conference and as a Clean energy enthusiast, my vision aligns with that of the conference," Singh said. "I attended this conference last year when I joined (Energy Systems) at UIUC and was very moved by the presenters and the research going on to help fight climate change."

Singh grew up with first-hand knowledge of limited energy resources. "I have spent my childhood in the most remote and isolated regions of India with the toughest terrains, as my father's job demanded so," she said. "Difficult terrains made electrification an arduous task in these regions and I spent most of my time in the absence of electricity. From not being able to watch TV to resorting to other means of energy for light during night to study, was routine.

"As soon as I finished my Bachelor's (electrical and electronics engineering, SRM University, Chennai, India, May 2016), I started looking for programs that offered something that has always been a motivation in my life, which is to work towards making clean energy accessible to everybody at affordable prices," Singh continued. "The flexibility and the range of courses (in Energy Systems at Illinois) and the interdisciplinary aspect of the program immediately appealed to me, plus the chance of studying in one of the top five engineering colleges in the U.S. These were the factors that influenced my decision to pursue an M.Eng in Energy Systems."

She considered other programs before deciding upon Illinois. "I got admits from TUM (Munich, Germany), the University of Southern California and the University of Michigan, Ann Arbor, in similar programs. UIUC had some really interesting research going on and the fact that it had one of the best engineering colleges made me choose Illinois.

"I have learned some great skills and have been really inspired by the professors and students I have taken courses with," Singh concluded. "I plan on working and exploring the Energy industry for a while, to see what are the real problems in the real world. My eventual goal is to set up a social enterprise, based on energy, that can help the people who are still living with no or scarce electricity/energy in a way that can empower them and help them develop. Also, I want to contribute in whatever way I can to promote cleaner, more efficient energy for sustainable development."

Energy Systems team proposes additional charging stations to increase electric vehicle use on campus

An Energy Systems student project to promote the use of electric vehicles on the Urbana campus by increasing the number of charging stations available has received University of Illinois Student Sustainability Committee funding.

The Energy Systems master's in engineering program provides a broad interdisciplinary education in energy systems for a variety of professional career-track students. As part of the coursework and to gain experience in all aspects of a project, the program's students are asked to seek funding for their ideas.

The team of Ari Krause, Adam Hijazi and Christopher Guida was successful in their charging station proposal. "We hashed out an idea and, working as a team, completed an (SSC) application that required both technical and feasibility components," Krause said. The SSC, committed to making a positive and lasting impact toward campus sustainability, rewarded the project a $5,000 grant.

"Our real inspiration for the project was that, whenever you go to a big city or some other campuses, there are very obvious signs for electric car chargers," Krause said. "On this campus we didn't see that, so we thought we should change it."

Added Guida, "Not only do electrical vehicles preserve the fossil fuel supply and switch to a more sustainable energy source, but they also improve the state of the students' health" by not adding carbons to the atmosphere.

"We thought this would make the university more attractive to anyone wanting to own an electric car in the future," Hijazi said.

Currently, only four Level 2 chargers have been established on the Urbana campus, with locations at the Alice Campbell Alumni Center, 601 S. Lincoln Avenue; the Krannert Center for the Performing Arts; 500 S. Goodwin Avenue; and the National Soybean Research Center, 625 S. Wright Street. Providing 240 volts of electricity, Level 2 chargers can power an electrical vehicle from zero to 100 percent in about four hours. In

comparison, typical wall outlets provide 120 volts of electricity, and take up to 13 hours to fully charge the same vehicle.

The students contacted administrators of five buildings on campus, and gained a positive response for locating two Level 2 chargers at the Transportation Building. The grant can be used to purchase equipment for university crews to have the charging stations installed.

Krause said the team's plan is in line with the Illinois Climate Action Plan (iCAP), which commits the campus to carbon neutrality by the year 2050. Part of the plan calls for phasing out university fleet vehicles and introducing low-emission models or electric vehicles.

"When people start seeing more of these university electric cars driving around, it will be engrained in their minds that electric cars are more of an option," he said.

The team's project is one of a variety of ways that Energy Systems students can approach the practicum requirement for earning the degree. The non-thesis degree is very flexible, and allows students to choose their own path and areas of specialization from a wide array of courses.

ENERGY SYSTEMS STUDENT SPOTLIGHT

PALLAV NIRMAL SHAH

What is your educational background?

I did my high school in the western part of India, Vadodara, Gujarat, where I am from originally, and then completed my bachelor's in technology in electronics and communications engineering from SRM University in Chennai, India.

What made you decide to pursue Energy Systems?

I have always been a curious kid. Science has always fascinated me. I was always interested in technology, and energy and sustainability as a topic felt like the right thing. I feel that the world needs better energy management and there are many parts of the world that do not have access to proper electricity and advanced cooking techniques. Since I have a background in electronics, this field relates with me as well as provides me access to many different courses that help me understand this part of the world. The freedom of choice in the MEng Energy Systems (degree) has helped me explore subjects from the Physics Department, Material Science and Engineering Department, Technology Entrepreneurship, Landscape Architecture and many other fields.

Did you consider other institutions for the program, and why did you choose Illinois?

I did consider a couple of other top institutions but I had an unwavering hope of studying in one of the top schools of this country. Also, John Bardeen, who is the cofounder of the transistor and was a UIUC faculty member and two-time Nobel prize winner, was always an inspiration in my undergraduate years. I knew that this institution will expect the best from me and bring the best out of me. UIUC has always been my destination. Despite my background in ECE and my grad courses in Energy System, this college gave me wings to pursue my other passions in science which included me being part the PV/Electrical lead at the Solar Decathlon Team and for a brief time work as a Verilog assistant for the UIUC CERN- Large Hadron Collider team. So, the college has helped me pursue my passion in energy systems while allowing me to explore my interests in physics, research and technology in general.

Have you considered what project you want to do as part of the degree program?

I opted for the curriculum option for the project but coincidentally the class that I took ended up being the reason for my project and current research. (website: www.sunbuckets.com/)

I am currently researching with Sun Buckets, which was founded by UIUC Prof. Bruce Litchfield and other UIUC alums. I work with Professor Litchfield for my independent study on Sun Buckets, which is a chargeable solar stove that utilizes thermal storage and can be used even after the sun has set. As part of their engineering team, I conduct embodied energy analysis, materials analysis, manufacturing, prototype designing and solar tracking. Sun Buckets prototypes operate in parts of the U.S., Haiti and India, as well.

Having said that, I am also working with SEDAC–Smart Energy Design Assistance Center, which conducts energy audits and analysis and provides energy saving recommendations to different public institutions as part of UIUC and the 360 Energy Group Collaboration (website: smartenergy.illinois.edu/). The institution's executive director is Prof. Brian Deal, whose class I took as part of my curriculum.

What do you hope to do with the degree once you earn it?

This question is a tricky one to answer. At this point I am very comfortable with many options open in the energy community, and I have options ranging from SEDAC and other company interviews. I am also considering spending some time continuing my research with Sun Buckets as they try to solve the energy problem in regions that face difficulties in cooking efficiently either because of unavailability of resources or just primitive technology.

Another option is continuing the path of academia and understanding the reasons and crisis that the world is facing. I am very open to new experiences and exploring different avenues in the field of energy, technology and science.

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Mohaghegh promotes Illinois' leadership in socio-technical risk analysis

The 2011 disaster at the Fukushima Daiichi Power Plant in Japan and the catastrophic Macondo oil spill in the Gulf of Mexico in 2010 are bitter reminders of the critical need for innovative scientific solutions in risk management, risk-informed decision making, and regulation.

"At Illinois, we want to develop the research and educational infrastructure that will help solve the most challenging risk and safety issues for industries."

Mohaghegh

Zahra Mohaghegh, NPRE assistant professor and a faculty affiliate of the Beckman Institute for Advanced Science and Technology, is dedicated to positioning the University of Illinois at Urbana-Champaign as a global leader in socio-technical risk analysis.

Mohaghegh's goal is clear. "At Illinois, we want to develop the research and educational infrastructure that will help solve the most challenging risk and safety issues for industries," she said. To meet this goal, Mohaghegh, the director of the Socio-Technical Risk Analysis (SoTeRiA) research laboratory in NPRE, is advancing Probabilistic Risk Assessment (PRA).

PRA is the leading methodology for estimating the systematic risk for high-consequence industries. PRA is now one of the key pillars of the Risk-Informed regulatory framework for the Nuclear Regulatory Commission (NRC). Other U.S. and international governmental agencies have also begun to adopt PRA for decision making and policy setting. PRA is constantly being advanced to meet the demands and challenges of complex socio-technical systems. "Next-generation leaders must begin to think differently, using risk-informed solutions to initiate safe, resilient, sustainable, and socially responsible technological advancements to usher in an era void of technological accidents," said Mohaghegh.

With recent support from the College of Engineering, Mohaghegh is establishing the SoTeRiA Industry Affiliates Program (IAP), the first risk analysis IAP in academia to use big data applications to offer industries the latest research methods for real-time risk detection, monitoring, mitigation, and risk management. Having initiated collaborations with national and international research institutions, the SoTeRiA Laboratory plans, through this program, to expand risk analysis collaborations to develop tailor-made solutions for high-risk operations around the world. Industry members will work with the Illinois SoTeRiA IAP team to build specialized tools for solving the most challenging problems of industries and to develop training series that fit their business needs.

After completing her postdoctoral research appointment in 2011 at the Center for Risk and Reliability at the University of Maryland, Mohaghegh created a risk management consulting company in Boston. She made the move to academia in 2013 to fulfill her desire to teach and to interact with students through research.

Mohaghegh has established the SoTeRiA Laboratory, where a multidisciplinary team of students, researchers, and industry professionals are advancing PRA with scientific innovations in two key research areas: (i) spatio-temporal causal simulation of social and physical failure mechanisms, and (ii) the fusion of big data analytics with PRA.

When Mohaghegh joined the NPRE faculty, she transferred a large-scale industry research project sponsored by the South Texas Project Nuclear Operating Company to the university. The project involved developing an integrated risk methodology for the resolution of a 20-year, long-standing safety issue in the nuclear industry, Generic Safety Issue 191 (GSI-191), which was related to the performance of the emergency core cooling system following a loss of coolant accident. For the last four years, Mohaghegh and her graduate students have been involved in the risk-informed GSI-191 project, which recently gained NRC approval. This project reduced cost and worker radiation exposure while maintaining safety.

In 2015, Mohaghegh became the principal investigator (PI) of a five-year National Science Foundation (NSF) grant to quantify human error and organizational factors using big data analytics in PRA. In 2017, she became the PI for a three-year DOE grant for enterprise risk management to promote the sustainability of the U.S. nuclear fleet.

New discovery may lead to the development of super premium gasoline

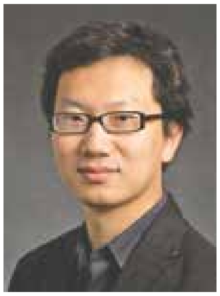
In contradicting a theory that's been the standard for over 80 years, an Illinois group led by Assistant Prof. Yang Zhang has made a discovery holding major promise for the petroleum industry.

The research has revealed that in the foreseeable future products such as crude oil and gasoline could be transported across country 30 times faster, and the several minutes it takes to fill a tank of gas could be reduced to mere seconds.

Using high flux neutron sources at the National Institute of Standards and Technology (NIST) and Oak Ridge National Laboratory (ORNL) in 2016, Zhang's group was able to videotape the molecular movement of alkanes, the major component of petroleum and natural gas. The group learned that the thickness of liquid alkanes can be significantly reduced, allowing for a marked increase in the substance's rate of flow.

"Alkane is basically a chain of carbon atoms," Zhang said. "By changing one carbon atom in the backbone of an alkane molecule, we can make it flow 30 times faster."

The discovery of Zhang, his graduate students Ke Yang, Zhikun Cai, and Abhishek Jaiswal, and collaborators at NIST, the Beckman Institute and Chemistry at Illinois, disproves a well-known theory that Princeton University Profs. Walter Kauzmann and Henry Eyring developed in the late 1940s. They had predicted that all alkanes have a universal viscosity near their melting points. Zhang said the theory had been cited over 3,000 times.


Zhang

However, a rather distinct odd-even effect of the liquid alkane dynamics was discovered. The odd-even effect in solid alkanes is taught in almost every introductory organic chemistry textbook, i.e., the difference in the periodic packing of odd- and even-numbered alkane solids results in odd-even variation of their densities and melting points. However, the same effect was not expected in liquid alkanes because of the lack of periodic structures in liquids.

"We would have thought that no structural memory may carry over from the solids to the liquids," Prof. Martin Gruebele, the James R. Eiszner Chair Professor in Chemistry, said, "but clearly, the cooler liquid already has the origins of the odd-even effect built into its diffusion!"

"The classical Kauzmann-Eyring theory of molecular viscous flow is over simplified," Zhang said. "It seems some chemistry textbooks may need revisions."

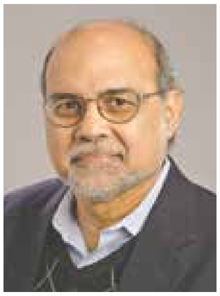
The Illinois scientists had the technological advantage of super high-speed (at the pico-second, 1 trillionth of a second) and super high-resolution (at the nano-meter, 1 billionth of a meter) "video cameras" making use of neutrons to take movies of the molecules.

NPRE researchers help prepare for future transport of spent nuclear fuel

Currently, while the federal government mulls policies to identify a permanent solution to store spent nuclear fuel, the material is kept in casks at reactor sites. In the meantime, University of Illinois nuclear scientists are preparing for the eventual safe transport of


Kozlowski


Meng


Uddin

the casks by developing means to monitor them internally.

A multi-disciplinary, multi-university team including Tomasz Kozlowski, Ling-Jian Meng and Rizwan Uddin of NPRE are participating in the $3 million Department of Energy Consolidated Integrated Nuclear Research (CINR) project. Led by the University of Houston, researchers from the University of Southern California, the University of Minnesota, the Pacific Northwest National Laboratory and Anatech Corporation also are taking part.

The project's main objective is developing a method of determining potential damage or degradation of the casks' internal components during normal transportation conditions, as well as hypothetical accident conditions.

"You have a cask that has to be transported, and then something happens," Kozlowski said of the possibilities that will be considered. "We need to know how to judge what happens inside the cask without tearing into it."

One consideration will be the possibility of human error in misloading fuel into the casks prior to transport. "We have to do risk analysis: Which other loading scenarios are there, and what are the chances of making this mistake?" Uddin said. "The arrangement in which spent fuel is loaded into the cask is important to avoid criticality."

Uddin's responsibility in the project will be to consider misloading scenarios, while Kozlowski will calculate burnup, the measurement of how much energy has been extracted from the fuel, and isotopic composition of the used fuel. Together, they will work on criticality evaluations.

The scientists will examine the viability of the casks in case of an accident, particularly after a long duration in storage.

Complementary to these computational efforts, the Meng team will be working with other investigators to develop non-destructive imaging techniques to allow assessment of the physical status of the fuel rods inside the casks. Meng's team will be specifically looking into the possibility of using time-tagged neutron to probe inside the casks and to obtain information on potential damage and dislocation of the fuel rods after transportation.

His team's work, using radiological imaging techniques to help determine the extent of potential damage or degradation of internal components, is particularly unique to this study.

NPRE researcher teams with Carle Hospital to improve quantitative accuracy in molecular imaging

Assistant Prof. Shiva Abbaszadeh has teamed with the Carle Foundation Hospital to use active cancer patient scans to improve the accuracy of molecular imaging technology for disease diagnostics and treatment.

Abbaszadeh is working with radiologist Brett Yockey, a Carle affiliate. Their project, "Improving quantitative molecular imaging accuracy in clinical practice and assessing response to therapy," has been awarded a one-year, $50,000 grant from the Carle Illinois Collaborative Research Seed Program of the Interdisciplinary Health Sciences Institute at Illinois.

Health care professionals use positron emission tomography (PET) scans to determine cancer patients' Standard Uptake Values, metrics that doctors use to evaluate and diagnose the disease for treatment.

Abbaszadeh

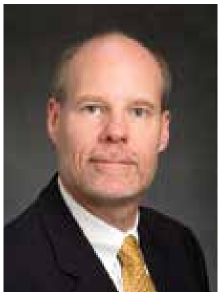
"The accurate quantification of the (SUV) value depends on so many factors, including the imaging modality used in the hospital, the detector technology used, and image reconstruction algorithms" Abbaszadeh said. "This value is really important but the accuracy is related to these parameters. I'm working to reduce uncertainty and improve quantitative accuracy."

Actual cancer patient scans allow Abbaszadeh to investigate and model the effect of patient individuality and patient preparation, system hardware, and software. This is particularly important, she said, if a patient comes back for follow-up scans. Her models take into account variations and ways in which they have been adjusted over time.

DOE supports NPRE work to improve safety, longevity of nuclear reactors

Improving safety, reducing costs and extending the lifetime of nuclear reactors drive the current research and experiments of several NPRE faculty members.

Mohaghegh



Heuser

Stubbins

The U.S. Department of Energy is supporting the work with grants from the Nuclear Energy University Programs (NEUP). The programs fund nuclear energy research and equipment upgrades at U.S. colleges and universities, and provide student educational support.

Mohaghegh team investigates systematic enterprise risk management

Assistant Prof. Zahra Mohaghegh and her research team, the Socio-Technical Risk Analysis (SoTeRiA) Laboratory, have gained a three-year, $800,000 grant. The team is working toward a future in which the nuclear industry could be void of catastrophic accidents, making nuclear energy cleaner, more profitable, and more sustainable.

Entitled "*Systematic Enterprise Risk Management by Integrating the RISMC Toolkit and Cost-Benefit Analysis*," the project will promote U.S. nuclear fleet sustainability by developing a systematic scenario-based Enterprise Risk Management (ERM) technology. The SoTeRiA group's undertaking will satisfy short- and long-term regulatory design standards, improve safety, create cost savings and avoid production losses.

In this project, Probabilistic Risk Assessment (PRA), integrated with the Idaho National Laboratory (INL) Risk-Informed Safety Margin Characterization (RISMC) Toolkit, will be used to quantify uncertainty nodes. The SoTeRiA team will work with INL risk experts to conduct a first-of-its-kind physics-social hybrid framework for quantifying long-term nuclear power plant enterprise risk scenarios.

As the Principal Investigator, Mohaghegh will work with collaborators from the College of Law at Illinois, the South Texas Project Nuclear Operating Company (STPNOC), ABS Consulting, and Texas A&M University.

Studying irradiation assisted stress corrosion cracking in LWR weldments may lead to LWR plant life extension

Prof. Brent Heuser leads a multiple university and national laboratory effort to investigate the effect of light water nuclear reactor environments on iron and nickel-based alloys. Extensive experimental and computational activities will be performed. This research is anticipated to lead to material improvements that support plant life extension under the U.S. Department of Energy Light Water Reactor Sustainability Program.

Researchers from Idaho National Laboratory (INL), Virginia Polytechnic Institute and State University, and the University of Michigan have joined Heuser, of Nuclear, Plasma, and Radiological Engineering at Illinois, in the project, "Experimental and Computational Studies of Stress Corrosion Cracking of Alloys 308/309 and 81/82 Weldments in Corrosive and Radiation Environment."

The U.S. Nuclear Regulatory Commission via the Report on Expanded Materials Degradation Assessment [NUREG/CR-7153] has identified LWR weldments as a critical focus since welds are susceptible to a process called intergranular stress corrosion cracking. "This can cause the component to fail and it has to be replaced," Heuser said. "It's not a safety issue, but it is a cost issue. The components are expensive to replace."

Heuser and the team have gained an $800,000 Nuclear Energy University Programs (NEUP) grant from the U.S. Department of Energy to conduct their studies. Heuser also has secured a second NEUP grant of $311,000 to establish in his laboratory a recirculating loop autoclave in which he can expose material samples to an environment simulating a LWR. The recirculating loop autoclave will be the first of this kind on the Urbana campus.

Heuser will be working with Benjamin Spencer and Sebastien Teysseyre of INL, Xianming Bai of Virginia Tech, and Gary Was of the University of Michigan. Weldments will be provided by EPRI.

Stubbins' technique identifies atom-sized defects in nuclear materials

Prof. Jim Stubbins and his students have gained access to advanced experimental facilities that will allow them to identify atom-sized defects in materials used for nuclear reactor construction.

The U.S. Department of Energy has provided Stubbins a $238,000 grant from the Nuclear Energy University Programs (NEUP) to test samples in the reactor at North Carolina State University. Stubbins and his group will use the reactor's positron beam to shoot positive electrons into material samples that have been irradiated in Idaho National Laboratory's Advanced Test Reactor.

Stubbins explained that positive electrons injected into a material search for negative electrons. Combining, they decay very quickly, shooting gamma rays in the opposite directions of which can be detected. The positron lifetime is a signature of the presence or lack of defects in the crystal.

Curreli's computer modeling research gains DOE-SciDAC, NSF awards

Assistant Prof. Davide Curreli's work on computer modeling of Plasma Surface Interactions has gained awards from the U.S. Department of Energy Scientific Discovery through Advanced Computing (SciDAC) partnership in Fusion Energy Sciences, and the National Science Foundation.

DOE-SciDAC project

The DOE-SciDAC project work, totaling $875,000 for Curreli's research program over the next five years, focuses on predicting the performance and the impact of Plasma-Facing Components in magnetic fusion reactors.

> "By using our two codes together we will provide a more complete description of the complex interconnections between the plasma and the wall."

Over the past few years, Curreli has been collaborating with the National Center for Supercomputing Applications to develop the Hybrid Particle In-cell (hPIC) computer code that simulates strongly magnetized plasmas close to the surface of a fusion reactor. The code has been tested on Blue Waters, the powerful supercomputer on the Urbana campus. Curreli has worked with his student, Rinat Khaziev, on this project.

Jon Drobny, another of Curreli's students, has been connecting hPIC with F-TRIDYN, a code for the prediction of sputtering and implantation during ion irradiation on solid materials.

Curreli

"Both sputtering and implantation processes play a fundamental role in driving the material response during plasma exposure," Curreli said. "Sputtering is responsible for impurity emission from a reactor wall's surface when bombarded by plasma ions. Implantation is responsible for composition modifications, and surface morphology evolution. The particle impurities coming from the wall can terminate the plasma, causing big problems for sustaining a fusion reactor."

The project's objectives are twofold:

- Develop high-performance simulation tools capable of predicting the lifetime of operating plasma facing component.
- Impact the evolving surface morphology and composition of tungsten-based components on plasma contamination, including the dynamic recycling of fuel species and tritium retention.

"By using our two codes hPIC and F-TRIDYN together we will provide a more complete description of the complex interconnections between the plasma and the wall. The hPic code will show how the plasma arrives to the surface, and F-TRIDYN will show what implants and what sputters off the surface," Curreli said.

The National Academy of Engineering has ranked understanding Plasma-Surface Interaction as one of the top problems of the 21st Century, representing one of the last steps to actual fusion reactors.

In addition to Illinois researchers, the project will include partnership with scientists from Oakridge, Argonne, Los Alamos, Lawrence Livermore, Pacific Northwest, and Sandia national laboratories; the University of California–San Diego, the University of Massachusetts-Amherst, the University of Tennessee-Knoxville, the University of Missouri, and Rensselaer Polytechnic Institute; and General Atomics of San Diego.

NSF Award

A modeling tool that Curreli is developing for plasma physics, plasma chemistry, and material interaction is a step toward building more sustainable food, energy and water resources.

Curreli and graduate student Shane Keniley are developing a software framework for the scientific community working in plasma physics to simulate a wide spectrum of plasma systems, ranging from the classical low-pressure industrial sources, to innovative chemistry-driven sources working at atmospheric pressure.

NSF supports their work through the agency's Software Infrastructure for Sustained Innovation. The program is aimed at transforming innovations in research and education into sustained software resources that are an integral part of the NSF cyberinfrastructure.

"Beyond classical applications, the software will have the capability to analyze plasma-liquid interfaces, which is of critical importance in fields such as plasma biomedicine, water purification, and stimulated growth of crops."

Plasma processes are traditionally used in a broad variety of industrial applications, ranging from the fabrication of semi-conductors, to the sterilization of medical equipment. More recently researchers have begun to consider the interaction of atmospheric plasmas with living cells for biomedical applications, discovering interesting intermediate regimes in which the plasma stimulates specific metabolic pathways of the cells without causing cell death.

"Instead of causing the necrosis of the cell, like in a normal sterilization equipment, the decrease of plasma fluxes to a living substrate encourages positive metabolic chemical pathways," Curreli says. "Modeling such a complicated system is challenging, and tools must be established to enable the work. We first have to understand how to control the amount of chemical radicals that the plasma delivers to the liquid layer outside a cell."

The goal of the new NSF project is to deliver an open-source software framework able to handle real-life problems where plasma chemistry plays a major role.

"We will expand the current software to include complex multi-phase chemistries, multiple-domain simulation of the interface between plasmas and other material phases, including liquids, and fully coupled electro-magnetic treatment of plasma systems. Beyond classical applications, the software will have the capability to analyze plasma-liquid interfaces, which is of critical importance in fields such as plasma biomedicine, water purification, and stimulated growth of crops," Curreli said.

"The resulting open-source framework will enable researchers from institutions around the world to contribute to the capabilities of this platform and advance the underlying science of these systems to move toward a more sustainable food, energy and water nexus," Curreli continued.

NSF has awarded Curreli $160,000 for the 2-year-long project. The project is a collaborative effort with North Carolina State University, and leverages collaboration not only between the two partnering universities, but with framework developers (Idaho National Laboratory), existing users (Oak Ridge National Laboratory), and the broader plasma community.

Curreli said that a workshop dedicated to the new software framework will be organized at two large plasma conferences in November 2018: the 60th American Physical Society Division of Plasma Physics and the 71th Gaseous Electronics Conference, which will be co-located in Portland, Oregon.

"These two conferences are traditionally attended by most of the plasma community, including people from the fusion side and people working on low-temperature plasmas," Curreli said. The workshop will offer an overview and training sessions to a large audience with the aim of accelerating the development, deployment, support, and training of this impactful simulation tool.

Zircher's virtual model reveals Engineering campus radiation levels

Through his virtual world, Christian Zircher can show just where the hot spots are on the engineering campus.

Clopping along the six-block area between Springfield Avenue and Green Street running north and south, and Goodwin Avenue and Wright Street running east and west, a resident of Zircher's simulation, *the Radiological Sensor Network within a Virtual Environment*, passes by areas lit mostly with blues and greens. The colors signify mild amounts of radiation, from 20-40 counts per second on a radiation detector.

But nearer to the steps of Wesley United Methodist Church on Green, a tower of color emerges, stretching from blue to green to yellow to red and even black, signifying counts of 80 to 90 per second. Zircher explains the church's granite steps are made of thorium or uranium, both radioactive materials.

An even greater column of color (and higher radiation count) is detected near a wall of the Nuclear Research Laboratory, on Goodwin. Inside the building at that spot is a laboratory where a large radioactive cesium source is stored.

Having earned his master's degree in May in NPRE, Zircher has blended in his project the research focuses of Department Head Rizwan Uddin, who has gained international recognition for applying virtual reality game technology to nuclear engineering, and former faculty member Clair Sullivan, who is an expert in radiation detection.

"In our group, we have a radiation sensor network made with mobile detectors that have been carried around campus," said Zircher, who also earned a bachelor's in NPRE in 2015. "I'm in charge of visualizing the data so it's understandable to people without nuclear backgrounds."

Sullivan's students carried mobile sensors across campus to collect the radiation readings. Kept in cloud storage, the data was cleaned and analyzed. At that point, Zircher's work began.

"I've written a script that first pulls the data down from the cloud storage unit and streams it into the Unity (virtual game) environment," he said. "I used a human character (in the game) to mimic walking with the data. As the color moves up the color spectrum, the higher the radiation." The yellow and red and black colors appear when the radiation rises above a certain threshold.

"The red alarms will stay (lit) rather than disappear so you know where to further investigate; it marks the location of higher radiation," Zircher said. "Outside NRL the readings get to black, but it's still safe as long as you don't stand there forever.

"The idea behind the project is to make very visible anything that would be above the background (radiation levels)."

The project has been a culmination of two years of work for Zircher. In building the realistic simulation, he has used SketchUp, a modeling program favored by architects, as well as photographs he has taken himself or has downloaded from Google Earth. Helping him on the modeling process has been NPRE undergraduates Aries Loumis and John Helck. Presented at the 2017 American Nuclear Society Student held in April in Pittsburgh, the project won the "Best in Track, Nuclear Nonproliferation Safety" award.

The most challenging part of the project was bringing data points into the Unity game system. "I had no idea how to put dynamic data into a virtual environment to visualize it," Zircher said, "but eventually I figured it out. All the programming and data streaming/visualization I've done on my own. It was really sporadic; I kept having 'Eureka!' moments."

Next steps for the work would be to show radiation level fluctuations in the area in real time–Zircher's version can lag up to 10 minutes–and create a historical heat map that shows information collected from data points over a period of time.

NPRE students gain valuable lessons from Nuclear Innovation Bootcamp experience

Alyssa Hayes, Ari Krause and Katie Mummah returned from this summer's Nuclear Innovation Bootcamp with more than just bragging rights.

Krause

Mummah

Hayes

The three engineers performed well in the camp's final day presentations, held in July at the University of California-Berkeley. Hayes, an NPRE junior, was a member of the First Place team, NuWorld Modular Manufacturing. Krause and Mummah, who earned bachelor's degrees in NPRE in May, led Atomic Analytics, which was the competition's runner-up.

> "I found the breadth of the lectures that we had was so incredible—we learned about marketing, the legal and regulatory framework for starting a company, and how to get funding."

As gratifying as it was to impress their judges, the three found the knowledge they brought back home with them to be what they valued most.

"I wasn't quite sure what I expected; I didn't really know what we would get lectured on for two weeks," said Mummah, who is continuing graduate studies in nuclear engineering at the University of Wisconsin this fall. "But I found the breadth of the lectures that we had was so incredible–we learned about marketing, the legal and regulatory framework for starting a company, and how to get funding."

As Hayes continues pursuing her degree in NPRE, she's grown more aware of the opportunities in innovating nuclear engineering technology.

"It helped me expand my interests and is helping me think about what I actually want to do with my long-term career," Hayes said. "I'm not going to do my own startup, but I'm thinking more like a business person now. Every time I have a problem, I think, 'There's a market for this.'"

> "It was refreshing and invigorating. people we met and talked with are succeeding in a startup in nuclear."

Krause, who is now earning a master's of engineering in Energy Systems at Illinois, already is part of a startup company. He's the co-founder and Chief Operating Officer of Lumos Industries, dedicated to creating safe, renewable and passive systems to store, cool and generate electricity from spent nuclear fuel. Networking at the bootcamp with professionals who have formed nuclear energy startups confirmed Krause's own passions.

> "I'm not going to do my own startup, but I'm thinking more like a business person now."

"It was refreshing and invigorating," he said. "One of the most important things I got from it was just the sense of relief that people we met and talked with are succeeding in a startup in nuclear."

Cues from successful nuclear startup company NuScale Power led Hayes and her teammates to the idea for the bootcamp's winning presentation, NuWorld Modular Manufacturing. The company calls for an assembly plant method to cost-effectively construct small nuclear reactors to meet the need for expected energy growth and replace decommissioned reactors.

Mummah and Krause were the Chief Executive Officer and Chief Financial Officer, respectively, for Atomic Analytics. Recognizing the uniformity of regulations and safety issues that are unique to the nuclear industry, the team based Atomic Analytics on nuclear power utilities' need for an accessible, easily searchable database to share information about individual plant events.

NPRE students develop startup to harness energy from spent nuclear fuel

NPRE students are creating and leading Lumos, a startup company built to harness energy from spent nuclear fuel.

The idea for the company arose from a senior design project Aristidis (Aries) Loumis and Ari Krause developed in spring 2016. After spending time in Sweden to study Nuclear Waste Management under the Royal Institute of Technology in Stockholm, and touring the facilities of the Swedish Nuclear Waste Management Company (SKB), the pair learned more about world class nuclear storage techniques. They noticed, however, that heat dispelled through the spent fuel's decay could be put to better use.

For years after it's used as an energy source, spent nuclear fuel retains heat because of all the thermal heat it emits. The heat is produced when gamma radiation, a high energy radiation with a small wavelength, comes into contact with another entity, allowing it to cascade longer wavelengths of thermal energy into the lower energy.

Rather than spending energy by constantly cooling casks containing spent nuclear fuel, Loumis and Krause decided the heat coming from the casks could be used to generate more electricity. "Electricity is generated in this system by heat coming from the casks, in tandem with heat coming from solar radiation, (it's also) generated from the atmospheric temperature difference with respect to altitude," Loumis said.

With a patented technology, Lumos' system would generate electricity from the heated air around the casks. The design is based on a modified solar updraft tower concept that also acts as a storage facility for spent nuclear fuel. Underneath the covering, nuclear storage casks would be positioned throughout, emitting heat. Coupled with the solar heat from the sun's rays underneath the plastic, the entire area would turn into a very warm pocket of air, that can escape only through a tall chimney in the middle of the structure. The hot air escaping would create an upward current of air that would turn wind turbines positioned near the bottom of the chimney structure. The moving turbines would generate electricity.

"The current spent nuclear fuel storage sites built on site were not meant to store this much waste for this long."

Currently, long-term nuclear storage remains a controversial issue in the United States. With over 100 reactors and 72,000 metric tons of nuclear waste, no consensus has been reached on what to do regarding storage casks or the fuel itself. With Lumos' solution, the deficit of controlling the spent nuclear fuel's heat would turn into an asset, creating clean energy with what is historically referred to as waste.

"The current spent nuclear fuel storage sites built on site were not meant to store this much waste for this long. So, they're having to spend money on expanding their storage sites, which in turn puts the cost on the consumer in the end, in the form of increased electrical prices," said Krause. This could be mitigated with Lumos' design, which will use nuclear waste to convert into more energy for consumers and free up space at existing sites.

In addition to the space saved, Loumis noted that spent nuclear fuel storage sites would not have to "(spend money) on cooling (spent nuclear fuel) in pools instead of passively cooling it outside in dry casks," thereby saving both the companies and their consumers money, as well as allowing Lumos to safely harness an energy-rich resource.

After being accepted into the University of Illinois' iVenture program, as well as National Science Foundation's (NSF) i-Corps program and ANSYS Startup Program, Lumos is making headway in achieving its goal.

ANSYS Startup Program and the NSF i-Corps program allow Lumos to take its work one step further by providing essential planning materials and information. "(ANSYS) allows us to do our simulations at reasonable prices," Loumis said. In i-Corps, ventures such as Lumos can "learn how to apply science-related technology, how to commercialize science-related technology and apply to things like SBIR (Small Business Innovation Research) and STTR (Small Business Technology Transfer) grants" for more information and funds to pursue research.

With this assistance, Lumos intends to focus on its research and development, and pursue further support and partners in the nuclear industry and renewable clean technology industry.

Team Members

- Xue (Selina) Han, PhD Agricultural and Applied Economics
- Emilio Mondragon, Graduate student, Civil & Environmental Engineering
- Tyler Kennelly, NPRE senior
- Ben Junkroski, NPRE senior
- Bradley Ellis, NPRE senior
- Mitchell Whalen, NPRE junior
- Kelly Munkhtuya, NPRE junior
- Ryan Pullara, NPRE junior
- Alexandra Greulich, English junior

NPRE pivotal in educational forum as Illinois vote saves two nuclear power plants

The informational session the Department of NPRE helped host a year ago played a role in successfully averting the closure of the Clinton and Quad Cities nuclear generating plants in the state.

NPRE led in co-organizing the forum, "Nuclear Power: What it means in Illinois," held in Chicago in October 2016. A host of national policy makers and leaders gathered there to inform the public and state lawmakers of the consequences of the closures in terms of job and tax base loss, as well as the loss of a reliable, environmentally friendly energy source.

State lawmakers were invited to the forum and afterwards were provided with a written report outlining the expert speakers' explanations and conclusions. In a dramatic, last-minute effort, the Illinois General Assembly in December 2016 passed the Future Energy Jobs Bill that made it possible for Exelon Corporation to continue operating the plants. Gov. Bruce Rauner signed the new law soon afterwards.

Jim Stubbins, NPRE Department Head at the time of the crisis, and Rizwan Uddin, current NPRE Department Head, worked with the American Federation of Labor and Congress of Industrial Organizations (AFL-CIO) and North America's Building Trades Unions to draw a laudable list of speakers to the forum. Among them were Congresswoman Cheri Bustos, whose Congressional District includes the Quad Cities; Lonnie Stephenson, International President of the 750,000-member International Brotherhood of Electrical Workers; and John Kotek, who was Acting Assistant Secretary for the U.S. Department of Energy Office of Nuclear Energy at that time.

Speakers also included Illinois State Sens. Donne Trotter, Chapin Rose and Neil Anderson, who sponsored the Future Energy Jobs Bill that promoted market-based solutions to keep the plants open. The bill establishes a Low Carbon Portfolio Standard (LCPS) to help reduce carbon emissions, increase renewable energy and maintain a stable and secure electricity supply in the state.

The event was part of NPRE's Leadership Speaker Series, intended to provide a forum for global leaders to present policies and platforms that shape the sciences of nuclear, plasma and radiological disciplines.

From left, speakers Cheri Bustos, Lonnie Stephenson, and John Kotek.

"Illinois is the birthplace of nuclear power," Stubbins said. "The state has been an international leader in the development and uses of nuclear energy. With about half of the electricity in Illinois coming from nuclear power plants, we should value and preserve them all for their major current and long-term contributions to energy and a low-carbon environment in Illinois."

Other speakers at the forum were:

- Jeffrey Binder, Director, Applied Research Institute at the University of Illinois
- David Foster, Senior Advisor, for DOE
- Matt Bennett, Senior Vice President, Third Way
- Maria G. Korsnick, Chief Operating Officer, Nuclear Energy Institute
- William Hite, General President, United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry, United States and Canada
- Petros Sofronis, Director, WPI International Institute on Carbon Neutral Research at the University of Illinois
- David Boyd, MISO External Affairs Team
- Susan F. Tierney, Senior Advisor, Analysis Group
- Tim Followell, City Administrator, Clinton, Illinois
- Henry Marquard, Director of Government Affairs, Quad Cities Chamber of Commerce

Prof. Roy Axford retires after 51 years of service to Illinois and the country

A contingent of the Los Alamos National Laboratory "Axford Mafia" traveled to the University of Illinois Urbana campus last April with a clear objective in mind: to thank their mentor, Prof. Roy Axford, and to present him a plaque of recognition.

Los Alamos representatives Scott Ramsey, Brian Temple, and Michael Steinkamp made the presentation during the NPRE Honors Banquet. Steinkamp told those gathered that Axford's 40-plus years of consulting work at Los Alamos, along with the work of generations of his students who joined the lab after graduation, have been instrumental in assuring the viability of the country's nuclear weapons stockpile.

"We'd like to present Professor Axford with a plaque of recognition for his years of service to the lab and, ultimately, to the nation," Steincamp said.

While Axford spent many summers from the 1960s to the early 2000s working at the lab and building the web of scientists responsible for the country's nuclear weapons program, his main career focus has been teaching at the University of Illinois. After 51 years of outstanding service, and after having taught almost every nuclear engineering student who went through the program during that timespan, the illustrious professor has decided to retire.

From left, Scott Ramsey, Michael Steinkamp, Roy Axford, and Brian Temple

Some of the members of the Los Alamos National Laboratory "Axford Mafia," with one of the prized Axford sweatshirts.

Department Head Rizwan Uddin said NPRE, the College and the University owe Axford a huge debt of gratitude. "I am very honored to count myself among those who took an 'Axford class'," said Uddin, an NPRE alumnus. "Professor Axford's lecturing style has ever since been an inspiration, guiding my own."

Axford tells his own story best in "A Word from Roy Axford," recorded in 2014 and available on YouTube (youtube.com/watch?v=YdN87P-32gc). He was the first person in the United States to earn a doctorate in nuclear engineering. His journey from earning his degree at the Massachusetts Institute of Technology (PhD 1958) and helping to design MIT's nuclear reactor, to his faculty positions at Texas A&M, Northwestern University and, since 1966, the University of Illinois, mirrors that of the evolution of nuclear engineering education in this country.

Throughout his journey, Axford has demonstrated a complete mastery of NPRE's curriculum, much of which he developed, and has been passing that knowledge on to his students. Several have acknowledged and expressed their appreciation for those lessons, as shown in the next few pages. The University of Illinois Urbana campus and the College of Engineering have recognized Axford's contributions with almost every teaching award.

Perhaps the ultimate symbol of students' admiration manifested itself a few years ago, when the student ANS chapter at Illinois decided to put Axford's image on T-shirts and sweatshirts. The apparel have been "must-haves" in the wardrobes of alumni and students ever since.

"I gained an immense amount of knowledge from Professor Axford related to our field, but what sticks with me the most is what a gentleman he was to those around him. Truly a great person!"

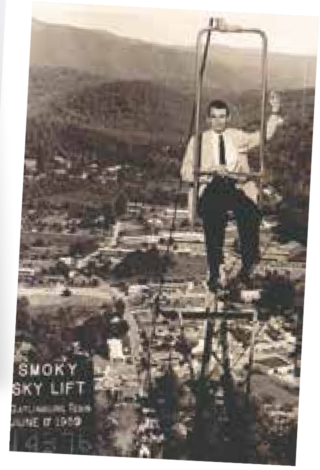
—Harrison Pappas, BS 08, MS 09, MBA 11

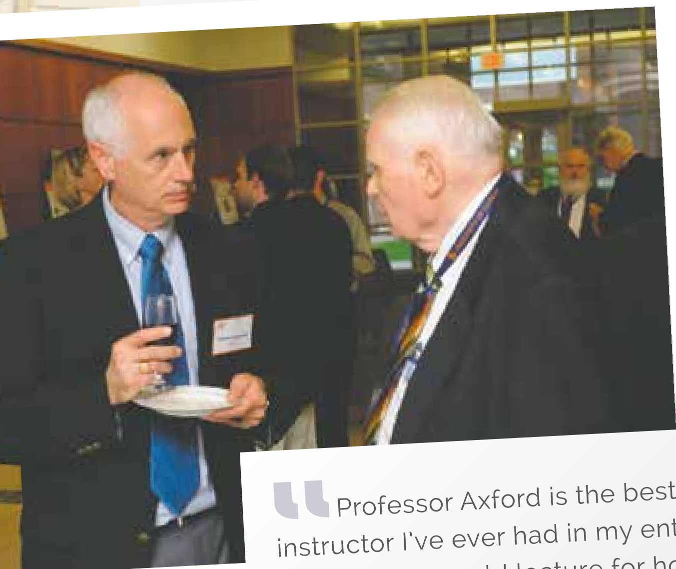
"Professor Axford has been my role model in my academic career. I hope I will have the energy and enthusiasm to stay on as long as he did."

—Tunc Aldemir, MS 75, PhD 78

"Prof. Roy Axford was one of the best instructors I had at the University of Illinois. His command of advanced mathematical techniques in his lectures was dazzling."

—Jack De Veaux, MS 79, PhD 83





"Professor Axford is the best instructor I've ever had in my entire life. Sure, he could lecture for hours on a complex topic without notes, which is very unusual, but what makes him a great teacher is the clarity of presentation, logical layout of material, depth of answers, and homework/tests to ensure understanding. He was my PhD advisor and mentor and taught me not only the intricacies of Lie group theory but how to do research and learn on my own. He has left many students as his legacy to his long and excellent career. I owe him everything for my professional preparation and development."

—Stephen Coggeshall, MMus 84 (Music); MS 82; PhD 84

"Professor Axford was my assigned advisor when I was a freshman in NPRE (Nuclear Engineering back then). I remember being intimidated by his stature and historical standing, but his demeanor quickly put me at ease. Professor Axford was always willing to take time to meet with me and help guide my decision making while a student. Although I didn't end up in the NPRE field, I believe that the manner in which he treated me became a model for how I handle my employees today."

—Craig Vodnik, BS 92

"He participated by teaching classes at Illinois Power in the middle 1970s as part of an off-campus master's degree program. I was one of his students and was able to complete the program. He was an excellent teacher to us off-campus students."

—**Anthony Artman, MS 78**

"Professor Axford was my neutron interaction theory professor. The class and his use of variational calculus is etched in my mind. I had a math degree as an undergrad at U of I, and he blew me away. I can't do the math anymore, but Professor Axford made a big impression."

—**Greg Frey, BS 79 (Chemistry), BS 79 (Mathematics), MS 80**

"Roy was my thesis advisor in 1979 and acquired graduate funding for me from Los Alamos National Laboratories which was instrumental in helping me complete a degree that led to a successful 32-year career as a research engineer. I can't thank him enough!"

—**Steve Hatch, BS 78, MS 80**

"When I got my undergrad degree, I thought I knew a lot about math. Then I got into one of Dr. Axford's graduate classes. Oh boy, was I wrong! Thanks for the great education, Dr. Axford."

—**Brian Jelke, BS 89, MS 91**

"Congratulations, Professor Axford! I enjoyed your class even though I had to write as fast as I could to keep up with your rapid writing on the blackboard. You filled one after another until four were filled and then you would erase and start again! Amazing mind for math!"

—**Mark Paradies, BS 78 (Electrical Engineering); MS 85**

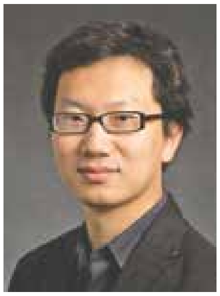
"It was about the 3rd day of an upper division neutronics class. The class was complaining about the homework; specifically, that it was too difficult. Professor Axford calmly turned and reassured the class that "nothing is difficult...only unfamiliar." And it took almost no time for it to sink in. Of course, this was true."

—**Daniel Kane, BS 82**

Zhang, Huff, gain ANS national recognition

NPRE faculty members continue to gain recognition from the national American Nuclear Society. This past year, Assistant Profs. Yang Zhang and Kathryn Huff received from ANS the Landis Young Member Engineering Achievement Award and the Mary Jane Oestmann Professional Women's Achievement Award, respectively.

Landis Young Member Engineering Achievement Award



Zhang

The honor recognizes outstanding achievement in which engineering knowledge has been effectively applied to yield an engineering concept, design, safety improvement, method of analysis, or product utilized in nuclear power research and development or commercial application. The award is restricted to ANS members who are less than 40 years of age at the time of nomination.

Zhang, who is also a part-time faculty member of the Beckman Institute of Science and Technology at Illinois, has been cited "for his contributions to nuclear and advanced experimental techniques to understand the complex makeup, nature and performance of materials in the far-from-equilibrium state."

An experimentalist, Zhang uses various media, including neutrons, photons, x-rays, and electrons, to probe the structure and dynamics of complex materials. He has directed his efforts to understand the structure of materials that have not settled into their most ordered, or crystalline, structure. Materials in non-equilibrium structure can often provide unique and sometimes enhanced performance properties. Among materials he has considered are new-generation complex alloys and kinetically-trapped soft matter.

In addition to his experimental work, Zhang synergistically combines atomistic materials computations with the experiments.

Zhang joined NPRE in October 2012. He earned his PhD in nuclear science and engineering in 2010 from Massachusetts Institute of Technology, and his bachelor's degree in electrical science and technology in 2004 from the University of Science and Technology of China.

He is the third among NPRE faculty to have been honored with the Landis Young Member Achievement Award. Associate Prof. Tomasz Kozlowski won in 2015, and Prof. Rizwan Uddin won in 1999.

Mary Jane Oestmann Professional Women's Achievement Award

Huff

Huff becomes the third consecutive NPRE faculty member to gain this distinction: Clair Sullivan, who was with the department from 2012-2017, won two years ago. Zahra Mohaghegh, also an Assistant Professor in NPRE, won in 2016.

The award recognizes outstanding technical achievement by a woman in the nuclear industry. A computational nuclear reactor physicist who joined NPRE in 2016, Huff has been cited for her tireless work to increase the adoption of modern, open source software development practices across the nuclear engineering community.

Huff has been instrumental in the work of the Software Carpentry Foundation, which holds workshops teaching best practice computational skills to researchers in science, engineering, medicine and related disciplines. In addition to leading in the organization of the workshops, Huff, co-wrote a book, *Effective Computation in Physics*, offering a long-form companion to the two-day workshop curriculum.

Huff has been extremely active in ANS since her student days, and was recognized with the 2016 Young Member Excellence Award for her involvement. She currently advises the ANS at Illinois student chapter. The student organization honored Huff earlier this year with the 2017 NPRE Teacher of the Year Award.

Huff earned a bachelor's degree in physics from the University of Chicago in 2008, and a PhD in nuclear engineering from the University of Wisconsin-Madison in 2013. Her PhD advisor, Paul Wilson, Grainger Professor of Nuclear Engineering, nominated Huff for the Oestmann Award.

Wet spent nuclear fuel storage project wins Hang Award

A project that would provide wet interim storage for used spent nuclear fuel has won the 2017 Daniel F. Hang Outstanding Senior Design Award.

Currently, decommissioned nuclear reactors bear the costs and responsibilities of storing and maintaining spent nuclear fuel on site. Katie Mummah, Jin Wan Bae, Dan O'Grady and Alex Lopez, now new NPRE alumni, offered the solution, *Nuclear Waste Wet Interim Storage* (NuWWIS).

NuWWIS calls for removing the spent fuel from decommissioned plants and transferring it to a centralized location.

The students' project would be able to store spent fuel currently in dry cask storage as well as that in wet storage. "NuWWIS will also ease the transportation of spent nuclear fuel when a final repository is opened, as all the spent nuclear fuel from all 27 decommissioned reactors would be coming from one location," Mummah said.

"All the spent nuclear fuel from all 27 decommissioned reactors would be coming from one location."

From left, Katie Mummah, Alex Lopez, Jin Wan Bae, Dan O'Grady, and Jim Stubbins.

The Hang award was created in honor of the late Emeritus Prof. Daniel F. Hang, one of NPRE's founders. Hang, who died at the age of 95 in December 2013, was passionate about nuclear engineering design, and emphasized the coupling of economics analysis with successful design work. He also strongly advocated students becoming licensed Professional Engineers.

NPRE ORGANIZES IRRMA X CONFERENCE

The International Topical Meeting on Industrial Radiation and Radioisotope Measurement Applications (IRRMA X)— a triennial event bringing together from around the world scientists and engineers who share an interest in radiation and radioisotope measurement applications—was organized by NPRE in the heart of downtown Chicago, from July 9–13, 2017.

Clair Sullivan, formerly an NPRE assistant professor, along with Bill Dunn, Head of Mechanical and Nuclear Engineering at Kansas State University, and John Mattingly, associate professor at North Carolina State University, were respectively the General, Technical and Program chairs.

The conference was devoted to current trends and potential future issues involving radiation and radioisotopes. Leading experts in their fields presented invited lectures as well as contributed oral papers and poster presentations of contributed papers during the technical sessions.

IRRMA X

Campus honors Uddin with Excellence in Guiding Undergraduate Research Award

Over the past decade, Prof. Rizwan Uddin has had many undergraduates work with him in the Virtual Education and Research Laboratory (VERL), where they have helped develop virtual reality learning experiences.

Recognizing his dedication to that segment of his group and the exceptional work they have accomplished, Uddin's colleagues have chosen him for the 2017 Campus Award for Excellence in Guiding Undergraduate Research.

Uddin and his undergraduate research groups have used gaming technology to develop realistic experimental laboratory experiences that can be done on computers rather than with real hands-on equipment. The technology has been a boon to NPRE's instructional efforts since students can repeat lab exercises multiple times anywhere with a computer. Students are provided the means to prepare for and redo labs without having direct access to the facilities.

The undergraduate researchers use 3-D virtual reality to transform the understanding of many of the physical processes. The technology also can be used to train radiation safety workers on how to enter and move around nuclear reactor areas that might induce radiation exposures. This training process can drastically reduce the time and exposure to those workers before they enter any real radiation environments.

The research has been featured as a cover story in the January 2013 issue of the *Nuclear News*, the national trade magazine of the American Nuclear Society. Attracted to the work have been undergraduates from NPRE, Computer Science, Electrical and Computer Engineering, Chemical and Biological Engineering, Materials Science and Engineering, and Industrial and Enterprise Systems Engineering.

Allain recognized with Dean's Award for Excellence in Research

By unifying concepts from nanotechnology, nuclear engineering and materials science, Prof. J.P. Allain earned the 2017 College of Engineering Dean's Award for Excellence in Research.

An NPRE alumnus as well as faculty member, Allain focuses on the interaction of radiation and plasma with surfaces and interfaces from the nanoscale to the mesoscale. He investigates rational design of dissipative spatio-temporal structures synthesized via irradiation synthesis, yielding high-fidelity control of material properties in areas that span nuclear materials, biomaterials and nano to mesoscale materials.

Allain's group has pioneered the use of in-situ and in-operando surface diagnosis and directed irradiation synthesis, complemented with multi-scale modeling developed to support these research themes.

In five years, the work has resulted in over 70 peer-reviewed publications, 100 contributed presentations and over 40 invited talks at major national and international meetings; as well as over $5 million in funding from the U.S. Departments of Energy and Department of Defense.

ANS at Illinois honors Huff, Stubbins, as teacher and staff member of the year

The American Nuclear Society at Illinois student chapter has recognized Prof. Kathryn Huff as 2017 Teacher of the Year, and Prof. Jim Stubbins as 2017 Staff Member of the Year.

Teacher of the Year

Huff hit the ground running since joining NPRE as an assistant professor in August 2016.

"In the short time she has been here at Illinois she has already taken on the role of our student section's advisor and has demonstrated an amazing ability to connect and educate her students through the addition of technology in the classroom," said Aristidis Loumis, ANS 2016–17 student chapter President.

In Fall 2016, her first semester teaching NPRE 412, Nuclear Power Economics & Fuel Management, Huff was included in the List of Teachers Ranked as Excellent by Their Students.

As the ANS at Illinois faculty advisor, Huff has devoted significant energy to the student group, including encouraging members' civic involvement at a time when Illinois state lawmakers considered legislation needed to continue operations of two nuclear plants. The legislation succeeded in December 2016.

Staff Member of the Year

As a faculty member and NPRE department head for 18-plus years, Stubbins has always made the educational experience of NPRE students his top priority.

Among his efforts, Stubbins has worked with the ANS at Illinois chapter to increase the chapter's impact at national ANS Student Conferences. He has coordinated with student leaders to schedule senior design projects so they are ready for presentation at the conference, and has provided departmental funding to support members' travel expenses. Those efforts have resulted in the Illinois chapter being recognized as the best ANS student section in 2016, an honorable mention for that recognition in 2017, and more presentation and leadership awards for the Illinois chapter than any other section the past two years.

Huff

Stubbins

"The ANS Student section at the University of Illinois chose Dr. Stubbins on the basis of his continued involvement and strong support of our student section," Loumis said.

Illinois students traveled with William Roy, Adjunct Professor for Nuclear, Plasma, and Radiological Engineering at Illinois, to the Aspo Hard Rock Laboratory in Sweden in June. This photograph was taken at a depth of about 470 meters. The large copper canister is intended to be the container of choice for spent nuclear fuel in Sweden. The students were enrolled in NPRE 498, Spent Nuclear Fuel Storage in Bedrock, a course hosted by the Royal Institute of Technology, SH262V Geological Storage of Nuclear Spent Fuel in Oskarshamn, Sweden. From left are Mitchell Whalen, Kevin Burck (chemical engineering), Zoe Richter, Rebecca Herr, Alec Kleczkowski, and Roy.

Illinois student chapter earns ANS distinction for second consecutive year

For the second year in a row, the American Nuclear Society student chapter at Illinois has earned distinction from the national ANS organization.

The student group gained an honorable mention for the 2017 ANS Glasstone Award, recognizing the society's most outstanding student section in the country. The honor follows last year's success, in which ANS at Illinois won the Glasstone Award.

The 2017 recognition reflects the student group's defense of nuclear energy plants that had been targeted for closure last fall in the state of Illinois. Citing financial losses at the generating stations in Clinton and the Quad Cities, Exelon Corporation had proposed to close the plants until the state government passed last-minute legislation that makes the plants more cost effective.

"The success of our chapter was primarily through focusing on advocacy, in the wake of possible nuclear power plant closures in Illinois, and getting more students involved," said Aries Loumis, 2016-17 ANS at Illinois president. "Our messaging was and is talking about how nuclear power is integral to a path with less fossil fuels and more renewable and overall less carbon intensive sources of energy. We held tables on the quad to talk about nuclear energy, and its vital role in combating global climate change. Most students at Illinois who get involved in nuclear engineering today are doing it because they care about the environment."

In addition to the specific effort on behalf of the Illinois power plants, the student group continued building on its overall reach and impact.

"We tried to branch out more to other student organizations like 'students for environmental concerns,' and Engineering Council," Loumis said. "We also continued to work with (NPRE

BROOKS GARNERS JAPAN'S ATOMIC ENERGY SOCIETY PROMISING RESEARCHER AWARD

Caleb Brooks, assistant professor of Nuclear, Plasma, and Radiological Engineering at Illinois, received the 2017 Atomic Energy Society of Japan (AESJ) Shorei-sho award. Translated as the "Promising Endeavor Award" or "Award for Emerging Technology," the Shorei-sho award recognizes emerging researchers with exceptional future potential in nuclear science and technology.

This award is the highest honor bestowed by the AESJ for scientists under 35 years of age who work in all nuclear science and technology research areas such as neutronics, thermal-hydraulics, materials, waste management, beam science and other areas. Brooks was cited by the AESJ specifically for his contributions to the area of boiling two-phase flow. He directs the Multiphase Thermo-fluid Dynamics Laboratory, housed in Talbot Laboratory.

Brooks joined the NPRE faculty in 2014 after earning his PhD in nuclear engineering at Purdue University. He also earned a master's degree in 2012 and a bachelor's degree in 2008 from Purdue. His advisor, Takashi Hibiki, professor and associate head in Purdue's School of Nuclear Engineering, nominated Brooks for the award.

Prof.) Jim Stubbins on having students present their research from their senior design course. As a result we had both more attendance to the national (ANS) Student Conference and brought home more awards than any other student section in the country."

A total of 36 NPRE students attended the 2017 ANS Student Conference held in April at the University of Pittsburgh, and gained six awards for leadership efforts and technical presentations. Fifty-four students attended the 2016 conference at the University of Madison-Wisconsin, and that year's group also won more awards than any other student section.

"The ANS chapter at Illinois is exceptionally active among the student chapters in the United States this year," said NPRE Assistant Prof. Katy Huff, faculty advisor to the student group. "This was reflected particularly in their civic involvement at the Illinois state level. When nuclear plants in Illinois were at risk, the students joined their fellow citizens, the NPRE Department, labor unions, and our state lawmakers in fighting for Illinois to recognize the value of those plants. Their passion and public action in support of the The Future Energy Jobs Bill (SB 2814) was energizing and surely contributed to a brighter future for the at-risk nuclear power plants in Illinois.

"Furthermore, the attendance and performance of the UIUC ANS student chapter at the Pittsburgh student conference was unmatched by their peers," Huff continued. "This academic year, these students never allowed an opportunity for professional development or nuclear advocacy to pass them by. They have made efforts to expand their already lengthy agenda of activities, hosted events, and outreach at every turn. This year, NPRE students traveled to the Clinton Nuclear Power Station, Argonne National Laboratory's Advanced Reactor Summit, and Oak Ridge National Laboratory for technical depth, as well as two trips to Chicago for civic engagement on behalf of nuclear energy."

ANS at Illinois group shines at national student conference

Again this year the American Nuclear Society at Illinois student chapter did very well at the national ANS Student Conference, garnering more awards than any other student section.

"The active, enthusiastic students in attendance were excellent representatives of the University of Illinois and the NPRE Department," said Katy Huff, NPRE assistant professor and faculty advisor to the ANS at Illinois group. "The unmatched accolades they earned for their technical presentations, posters, and other professional involvement demonstrated that NPRE Illinois students are both technically and professionally at the top of the nation."

Among awards gained at the 2017 conference held in early April at the University of Pittsburgh was a Commendation for Service and Leadership for ANS at Illinois student chapter President Aristidis Loumis. In addition to promoting membership and activity in ANS among NPRE students throughout the past two years, Loumis was instrumental in encouraging the participation of the 36 NPRE students that attended the national student conference.

Other awards received by NPRE students were:

- Second Place for Best Overall Paper and Best in Track, Reactor Physics: NPRE students Matthew E. Kabelitz and Xu Wu, and NPRE Assistant Prof. Tomasz Kozlowski, "Examination of Boundary Flux Anomalies in Scale Simulation Codes."
- Best in Track, Fuel Cycle & Waste Management: NPRE student Jin Whan Bae, Huff, and NPRE Adjunct Prof. William R. Roy, "Benefits of Siting a Borehole Repository on Non-Operating Nuclear Facility."
- Best in Track, Isotopes & Radiation: NPRE student Kelsey Luo, "Distributed Mobile Sensor Network for the Detection of Radioisotopes."
- Best in Track, Nuclear Nonproliferation Safety: NPRE students Christian D. Zircher, Jon Helck and Loumis, and NPRE Assistant Prof. Clair J. Sullivan and NPRE Prof. Rizwan Uddin, "A Continuation of Radiation Sensor Network within a Virtual Environment."

PARSONS COMBINES PLASMA MODELING WITH EXPERIMENTAL WORK USING HIDRA

Fresh from his year in France as a Fulbright Grantee working on the ITER project, one of the most ambitious energy projects in the world today, Matthew Parsons has been awarded a National Science Foundation Graduate Research Fellowship to support his PhD work.

Now working with Prof. David Ruzic in the Center for Plasma-Material Interactions, Parsons chose to come to Illinois in large part to work with HIDRA, the center's unique plasma/fusion facility.

In addition to his work with the International Thermonuclear Experimental Reactor (ITER), Parsons has gained experience at the Princeton Plasma Physics Laboratory, first as part of an undergraduate co-op program through Drexel University, and later as a contracted researcher. His PPL work involved applying machine learning methods to predict plasma disruptions in tokomaks, fusion devices used to confine plasma.

"(A disruption) can happen in 10s of milliseconds to a few 100 milliseconds, and there's not always warning that it will happen," Parsons said. "It can be dangerous for the machine when the plasma slams into the (tokomak) walls with a lot of extra heat. There's not really a physical model for when these disruptions occur; we know some reasons why, but they're really complex.

"I came up with a very simple way to analyze these very complex machine learning models to get information that would be useful to predict disruptions," he said.

Parsons continued the research during his year at ITER. At Illinois, Parsons works with Assistant Prof. Davide Curreli and Research Assistant Prof. Daniel Andruczyk to combine computational modeling with experiments on HIDRA.

"Here, I'm going to be doing more hands-on work," he said. "There are very few places in the world where you can get hands-on experience with a machine like this."

Upon earning his degree, Parsons would like to work in research management and policy. "I consider myself in a big picture kind of position, with science outreach and advocacy," he said.

RADAIDEH GAINS ORNL RECOGNITION FOR NUCLEAR MODELING AND UNCERTAINTY QUANTIFICATION WORK

A study at Oak Ridge National Laboratory to better define uncertainties in nuclear systems modeling has gained recognition for PhD student Majdi Radaideh.

Radaideh, a student of NPRE Associate Prof. Tomasz Kozlowski, won third place in the ORNL Nuclear Engineering Science Laboratory Synthesis Program 2017 Student Poster competition.

"We are developing an approach for Light Water Reactor systems to quantify the uncertainties in kinetic parameters so that we can use them in safety analysis for nuclear reactors," Radaideh said.

"The kinetic parameters describe the behavior of specific type of neutrons in the core–called delayed neutrons–that are very important for nuclear reactor control. Previously, people just used these kinetic parameters to describe the delayed neutrons as a point estimate, without any consideration of uncertainties of these parameters," Radaideh explained.

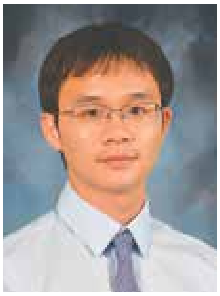
"Now, when we use these parameters plus their uncertainties, we can figure out how the reactor responses would be changed when considering those uncertainties. We have a clearer model of how the delayed neutrons behave and knowing that, can better control the nuclear reactor."

Radaideh has used ORNL supercomputers and SCALE, a comprehensive modeling and simulation suite for nuclear safety analysis, to perform his calculations. He has worked with Dr. Will Wieselquist, an ORNL staff member and major SCALE developer. The next step in the work, according to Radaideh, is to report the kinetic parameters with their uncertainties for various types of nuclear systems and make them available for applications in industry and academia.

Radaideh earned a bachelor's degree from the Jordan University of Science & Technology before coming to Illinois in Fall 2015. Working on computational thermal hydraulics and safety analysis, he earned a master's degree in Fall 2016 in NPRE, and has concentrated on uncertainty quantification for high dimensional problems for his PhD work.

CAI AWARDED BECKMAN INSTITUTE GRADUATE FELLOWSHIP

PhD Student Zhikun Cai has been chosen as a Beckman Institute Graduate Fellow for 2017.



The Beckman Institute Graduate Fellows Program offers Illinois graduate students the opportunity to pursue interdisciplinary research at the Institute. Research projects must involve at least one Beckman faculty member who carries out research at Beckman in addition to a second Illinois faculty member, and preference is given to those proposals that are interdisciplinary and involve the active participation of two Beckman faculty members from two different research groups.

Cai works with NPRE Assistant Prof. Yang Zhang, from Beckman's Autonomous Materials Systems Group, and Chemistry Prof. Martin Gruebele, from the Nanoelectronics and Nanomaterials Group. They are interested in studying the energy landscape of liquids and proteins using a kinetic approach they developed and extensive molecular dynamics simulations guided by experimental neutron scattering measurements. The goal is to improve the understanding of protein dynamics in vivo and to engineer the protein energy landscape by restricting the conformation space, which may lead to new catalytic applications and bio-preservation techniques.

Cai's research work focuses on understanding long timescale phenomena such as slow relaxation of viscous liquids and protein folding. Using statistical mechanics, the central question he wants to answer is how to establish a link between neutron scattering experimental measurements and the energy landscape concept. Applying the developed theoretic approach to study proteins dynamics under confinement is an important component of his dissertation work.

Cai earned a bachelor's in physics from the School of the Gifted Yong in University of Science and Technology of China in 2013 and a master's from NPRE in 2016.

SAKURAHARA RECEIVES ILLINOIS STUDENT GOVERNMENT'S TEACHING EXCELLENCE AWARD

Tatsuya Sakurahara, a member of Prof. Zahra Mohaghegh's research team, has received the Illinois Student Government (ISG) 2016-2017 Teaching Excellence Award.

Sakurahara was recognized for his dedication as a teaching assistant in two NPRE courses on Probabilistic Risk Assessment (PRA), NPRE 461 (Probabilistic Risk Assessment) and NPRE 498/598 (Advanced Risk Analysis), which Mohaghegh instructs. The ISG awards five Teaching Excellence Awards each year to recognize excellence in teaching and to show appreciation for outstanding University of Illinois instructors.

Sakurahara has been a graduate research assistant in the Socio-Technical Risk Analysis (SoTeRiA) Laboratory, since June 2013. His research focuses on the development of a new spatio-temporal PRA framework for fire risk assessment by integrating the CFD-based fire physics code, Fire Dynamic Simulator, with the PRA of nuclear power plants. He is also working on the development of a Global Importance Measure analysis to rank the critical physical and design parameters in fire risk models.

Sakurahara received a bachelor's in 2011 and a master's in 2013 from the University of Tokyo, Japan.

FIFLIS WINS COLLEGE AWARD FOR GRADUATE STUDENT OUTSTANDING RESEARCH

Peter Fiflis, who earned all three degrees from NPRE, won the 2017 College of Engineering Ross J. Martin Award for outstanding research achievement by a graduate student.

"Peter Fiflis has produced more outstanding research results than any other student I have advised," enthused Prof. David Ruzic, a 32-year veteran of the NPRE Department, in nominating his former mentee for the honor. In the first four years of graduate school, Fiflis produced 12 refereed journal publications, and was first author on eight of them.

Supported by a U.S. Department of Energy Office of Science Graduate Fellowship to study Fusion Energy Sciences, Fiflis worked in the Center for Plasma-Material Interactions that Ruzic directs. Among accomplishments, Fiflis designed an experiment that produced "tungsten fuzz," a material that can collect in energy fusion devices and seriously threaten fusion's application as a successful energy source. With Fiflis' ingenuity, CPMI researchers produced the tungsten fuzz without having access to a fusion device.

Fiflis also worked on liquid metal stability inside fusion devices. The research investigated how well a liquid metal wall can withstand strikes from hot plasmas without spurting the liquid metal all over the fusion device. Fiflis and colleagues performed experiments on CPMI's Divertor Edge and Vapor shielding eXperiment (DEVeX), developed to produce a pulsed, high density, high temperature plasma. He then traveled to the Netherlands to use the Magnum PSI plasma gun to test the ability of liquid-filled metal trenches to stand up to intense plasma strikes.

Fiflis earned a bachelor's in 2011, a master's in 2013, and a PhD in 2016. He currently is Lead Product Engineer for Chicago-based Tovala, a startup firm that produces internet-connected combi ovens.

NPRE BOASTS TWO UNDERGRADS AS 2017 KNIGHTS OF ST. PAT

Aristidis (Aries) Loumis and Katie Mummah, recent past presidents of the American Nuclear Society student chapter at Illinois, were chosen in March as members of the college-wide Knights of St. Patrick.

Knighthood is among the most esteemed honors an Illinois engineering undergraduate can achieve, and is annually awarded to only a handful of juniors and seniors among the more than 10,000 students studying engineering at the university. This was the first year in University of Illinois history that two NPRE students were named to the honor, recognizing leadership, excellence in character, and exceptional contributions to the College and its students.

Loumis and Mummah demonstrated identifiable leadership and organizational skills in Spring 2016. Their combined promotional efforts led 54 NPRE students to attend the national ANS Student Conference; the most of any university besides the host school, the University of Wisconsin-Madison. In addition, the Illinois chapter took home more conference awards and prizes than any other university in attendance.

Loumis and Mummah posted social media messages, talked with their fellow students one-on-one, and pitched the conference during classes to boost participation. Loumis also worked with the NPRE department to ensure that senior project design abstract deadlines aligned with the conference summary deadlines, so more students would have their work ready to compete in conference presentations.

Among other achievements, the exceptional conference showing led to ANS at Illinois being chosen for the 2016 ANS Samuel Glasstone Award, recognizing the Illinois chapter as the most outstanding student section across the country.

Student excellence recognized

Over 100 students were honored during the 2017 NPRE & ANS Honors Banquet.

Held in April in conjunction with the American Nuclear Society at Illinois Student Chapter organization, the NPRE event recognizes students for earning awards from the Department, College of Engineering, campus, national organizations and corporate partners. The event is sponsored in part by the Edward E. Mineman Memorial Endowment Fund. NPRE alumnus Edward F. Mineman, BS 84, and his brother Blaine A. Mineman, AB 85, Political Science, MBA 87, established the fund to honor their father.

NPRE Departmental Awards

The **NPRE Outstanding Academic Achievement Awards** to a Graduating Senior are presented to graduating seniors with the highest cumulative grade point averages

- Daniel J. O'Grady of Evergreen Park, IL

The **NPRE Outstanding Undergraduate Research Awards** are presented to undergraduate students who have performed exemplary research in the Department.

- Jin Whan Bae of Champaign, IL
- Grant M. Schumock of Geneva, IL
- John B. Smith III of Saint Charles, IL

The **Catherine Pritchard Undergraduate Scholarships**, honoring former NPRE secretary Catherine Pritchard, are presented to students who have shown academic ability and activities leadership during their first three years, to be used during the senior year of study.

- Kaitlyn A. Butler of Champaign, IL
- Alyssa L. Hayes of Gurnee, IL

The **Roy A. Axford Undergraduate Scholarship**, honoring NPRE Professor Roy A. Axford, is presented to a continuing student of high academic ability and achievement.

- Grant M. Schumock of Geneva, IL

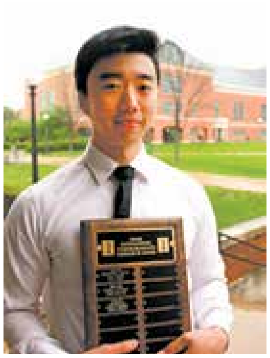
The **George H. Miley/Low Energy Nuclear Reactions (LENR) Undergraduate Scholarship**, honoring NPRE Prof. George H. Miley, is presented to a highly motivated, continuing undergraduate student in the Department.

- Jeremy J.H. Mettler of Sioux Falls, SD

The **Bruce W. Spencer Graduate Scholarship** was established in memory of alumnus Bruce W. Spencer, who earned a master's degree in 1965 and a Ph.D. in 1970 in Nuclear Engineering. Spencer built his career in experimental reactor safety research until his death in 2001. The scholarship is awarded to a graduate student of high academic standing whose research promises to advance the state of nuclear engineering, specifically as it relates to reactor safety.

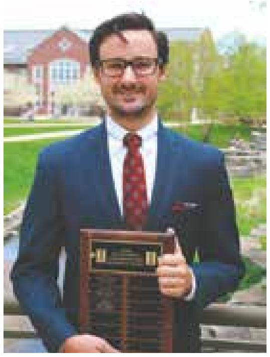
- Zhiee Jhia Ooi of Malaysia

O'Grady



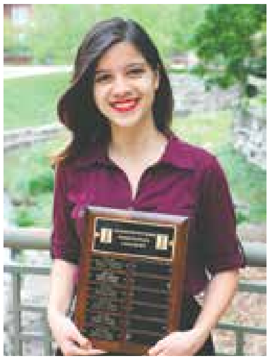
Bae

Schumock



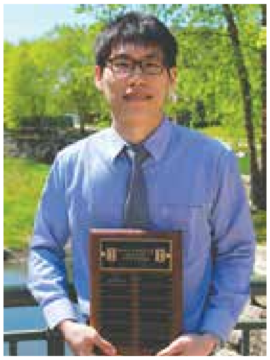
Smith

Butler



Hayes

Mettler



Ooi

The inaugural **Roy A. Axford Graduate Fellowship** was made possible following an extensive effort by alumni, including many of Professor Axford's former students, to honor their mentor while creating funding opportunities for NPRE students.

- Nathan P. Walter of Evanston, IL

The **Barclay G. Jones Graduate Fellowship** supports graduate fellowships in NPRE. In a grassroots effort, several alumni and friends established this fund in honor of Professor Jones, an icon of the University of Illinois nuclear engineering program since its inception. Professor Jones earned his master's degree and Ph.D. at the University of Illinois, and made his career here, helping to shape the present day department. The Barclay G. Jones Endowment Fund is the continued effort of NPRE graduates who also established the Catherine Pritchard Undergraduate Scholarship.

- Sundar Namala of Hyderabad, India

American Nuclear Society Student Chapter Awards

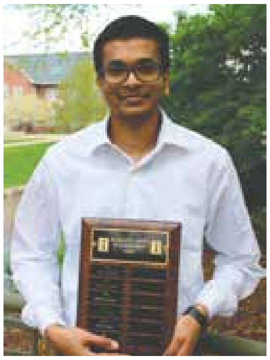
The Student Chapter of the American Nuclear Society selects the **ANS Undergraduate Outstanding Service Award** recipient. The undergraduate student who has most actively supported the ANS Student Chapter and its programs throughout the academic year is honored.

- Jeremy J.H. Mettler of Sioux Falls, SD

The Student Chapter of the American Nuclear Society selects the **ANS Graduate Outstanding Service Award** recipient. The graduate student who has most actively supported the ANS Student Chapter and its programs throughout the academic year is honored.

- Steven A. Stemmley of Bethalto, IL

Walter



Namala

Stemmley

To view more photos of NPRE's 2016 Honors Banquet, go to NPRE's Facebook page.

NPRE-at-Illinois

OTHER STUDENT HONORS

American Nuclear Society National Awards

2016 ANS Decommissioning & Environmental Sciences Division Undergraduate Scholarship

- Kathryn A. Mummah of Wheaton, IL
- 2016 ANS Raymond DiSalvo Memorial Scholarship
- Daniel J. O'Grady of Evergreen Park, IL

Nuclear Regulatory Commission—University of Illinois at Urbana-Champaign Nuclear Engineering Scholarship and Fellowship Program

The Nuclear Regulatory Commission directs this program that includes support for education in nuclear science and engineering, to develop a workforce capable of supporting the design, construction, operation, and regulation of nuclear facilities and the safe handling of nuclear materials.

SCHOLARSHIPS

- Peter M. Conway of Lemont, IL
- Quincy R. Crawford of Mahomet, IL
- Nicholas J. Dadufalza of Seven Valleys, PA
- Matthew E. Kabelitz of Northbrook, IL
- Daniel C. Martin of Glencoe, MO
- Jeremy J.H. Mettler of Sioux Falls, SD
- Emilio M. Mondragon of Chicago, IL
- Kathryn A. Mummah of Wheaton, IL
- Dhruval K. Patel of Hanover Park, IL
- Eric J. Riewski of Champaign, IL
- Grant M. Schumock of Geneva, IL
- Andrew J. Shone of St. Charles, IL
- Steven A. Stemmley of Bethalto, IL

FELLOWSHIPS

- Nathan E. Colgan of Champaign, IL
- Daniel J. O'Grady of Evergreen Park, IL
- Victoria Riso of Hamburg, NY
- Continuing Fellowships:
- Peter A. Mouche of Naperville, IL
- Nathan P. Walter of Evanston, IL

Exelon Corporation—Energy for Education Scholarship

This scholarship program was established to encourage talented students interested in a career with Exelon Corporation. Exelon does business in 48 states, the District of

Columbia and Canada, and is one of the largest competitive U.S. power generators.

- Adewale A. Adeyinka of Hoffman Estates, IL
- William R. Brockschmidt of Jacksonville, IL
- Maxx J. Villotti of Urbana, IL

IBM Ph.D. Fellowship

Gianluca A. Panici of New Lenox, IL, a graduate student working in the Center for Plasma-Material Interactions, has been awarded an IBM Ph.D. Fellowship. The program attracts applicants from all over the world from fields as diverse as computer science and engineering to physical sciences and processing engineering.

Lam Research Corporation Outstanding Graduate Student Award

Lam Research Corporation, the leading supplier of wafer fabrication equipment and services to the global semiconductor industry, has recognized graduate student Brandon Holybee of Champaign, IL, with the 2017 Lam Research Corporation Scholarship. Working with NPRE Prof. J.P. Allain, Holybee conducts research on low energy ion-solid interactions, self-organized nanostructuring, and nanotechnology of multicomponent systems. Holybee is finalizing his Ph.D. studies and collaborating with the Helmholtz-Zentrum Dresden-Rossendorf (HZDR) research institute in Dresden, Germany, on fundamental ion-solid interactions. The focus is on the mechanisms involved in the self-organization of ion-induced nanopatterns.

U.S. Department of Energy, Nuclear Energy University Program Scholarship

The U.S. Department of Energy awards Nuclear Energy University Program (NEUP) Scholarships and Fellowships to undergraduates pursuing nuclear energy-related engineering and science degrees.

SCHOLARSHIPS

- Alyssa L. Hayes of Gurnee, IL
- Patrick L. Hering of Crystal Lake, IL
- Jeremy J.H. Mettler of Sioux Falls, SD
- Kathryn A. Mummah of Wheaton, IL
- Daniel J. O'Grady of Evergreen Park, IL
- Grant M. Schumock of Geneva, IL

CONTINUING FELLOWSHIP:

- Joseph L. Bottini of Framingham, MA
- Katherine C. Hepler of Lincoln, IL
- Nicholas O'Shea of Chicago, IL

Graduate Research Fellowship

Sponsored by the DOE, Heather N. Sandefur of Urbana, IL, is working in the Center for Plasma-Material Interaction on a graduate research fellowship.

College of Engineering at Illinois Scholarships

The Engineering Visionary Scholarship Endowment Fund allows the College of Engineering to provide larger scholarships to more undergraduate students. These scholarships go to incoming first-year students and are renewable. Following is a list of NPRE students who have received the scholarships.

- Adolfo Baca of Addison, IL
- Christopher Bitters of Hinsdale, IL
- Siobhan M. Fox of Oak Lawn, IL
- Jesse A. Gardner-Owens of Springfield, IL
- Alyssa L. Hayes of Gurnee, IL
- Zachary J. Jeckell of Silvis, IL
- Jazz D. Kroeger of Washington, IL
- Nayeli Lara of Chicago, IL
- Aristidis E. Loumis of Champaign, IL
- Brandon M. Lowry of Earlville, IL
- Paul E. McClanahan of Columbia, IL
- Dhruval K. Patel of Hanover Park, IL
- Eliza D. Wright of Naperville, IL

Dario G. Panici of New Lenox, IL, has received the **William L. and Elizabeth A. Ackerman Scholarship.** William L. Ackerman was a 1934 graduate of the University of Illinois in Mechanical Engineering. The William L. and Elizabeth A. Ackerman Fund was established in 1989 to provide scholarships for undergraduate students in the College of Engineering at the University of Illinois at Urbana-Champaign.

Kathryn A. Mummah of Wheaton, IL, has received the **Crowe Horath LLP Scholarship,** available for an engineering major sophomore, junior or senior who is in good standing and is a U.S. citizen or Permanent Resident.

Kaitlyn R. Butler of Champaign, IL, has received the Edward E. and **Elizabeth Joanne DeZwarte Engineering Scholarship.** The Edward E. and Elizabeth Joanne DeZwarte scholarship fund was established in 1981 to provide scholarships for undergraduate students in the College of Engineering.

Eduardo Orozco Rodriguez of Chicago, IL, has received an **Engineering Excellence Scholarship.** The scholarship is given to freshmen admitted to the College of Engineering based on extremely high performance in ACT or SAT exams and high school work.

Zoe R. Richter of Manito, IL, has received the **Wilmer Hellenthal Scholarship.** Wilmer Hellenthal was a 1940 graduate of the University of Illinois at Urbana-Champaign, having earned his bachelor's of science degree in mechanical engineering. The Wilmer Hellenthal Scholarship Fund was established in 1993.

Jeremy J.H. Mettler of Sioux Falls, SD, has received an **Illinois Engineering Achievement Scholarship.** The scholarship is given to freshmen admitted to the College of Engineering based on extremely high performance in ACT or SAT exams and high school work, and is renewable.

Emilio M. Mondragon of Chicago, IL, has received a **PATHWAYS Engineering Scholarship** awarded to transfer students.

Engineering at Illinois Announces Barclay Jones as Distinguished Alumni Award Recipient

Barclay G. Jones, Professor Emeritus and former NPRE Department Head, has received the College of Engineering at Illinois Distinguished Alumni Award.

Jones has been cited for *his leadership and commitment in guiding nuclear engineering education over the past 50 years at the University of Illinois.* He was recognized on April 1, 2017.

Jones has been a guiding force in nuclear education not only at Illinois but worldwide throughout his career. His leadership, research, and commitment to the field of nuclear engineering have been unwavering.

Jones earned his bachelor's degree in mechanical engineering in 1954 from the University of Saskatchewan. In addition to helping on his family's homestead farm, Jones spent his undergraduate summer months in the Canadian Air Force as an officer training to be a pilot. He received his wings and served as a pilot in the Canadian Air Force during this time. Following these years, he became a licensed commercial pilot in Montreal, Canada.

Right, a young Barclay Jones conducts boiling heat transfer experiments. More recently, NPRE Assistant Prof. Caleb Brooks establishes his cutting-edge Multiphase Thermo-fluid Dynamics Laboratory.

Jones enrolled in graduate school at Illinois in 1958. While earning his degree, Jones worked for Prof. Bei Tse Chao in mechanical engineering. In 1960, Jones started work on his PhD and was encouraged to continue studying in the nuclear engineering department. In 1963, he began his teaching career at Illinois and was hired as a full time faculty member. Jones worked under Professor Chao conducting research on heat transfer. In fact, when Chao left the country for several months, Jones took over teaching his peers in graduate-level courses in heat transfer. In 1966, Jones finished his PhD program and became an assistant professor with the department. He was promoted to an associate professor in 1968 and full professor in 1972.

Jones served as the associate chair of the Nuclear Engineering Program from 1981-1986, and was acting head of the newly formed Nuclear Engineering Department for a year, then became the permanent department head for 13 years. In 2008, when the department celebrated its 50th anniversary, Jones was honored as one of the founders.

His research interests have included thermal-hydraulics, reactor safety, multiphase flow, boiling heat transfer, turbulence measurement and modeling, flow-induced vibrations and aeroacoustics, human-machine interfaces for reactor control and simulation, and food irradiation safety. Among his contributions were the development of an experimental apparatus to look at the behavior of suspended particles in turbulent pipe flow, and the development of an instrument measuring local fluctuating static pressure. Jones also led the design of the reactor coolant system for the University's Advanced TRIGA Reactor.

Jones is a Fellow of the American Nuclear Society, a faculty initiate of Tau Beta Pi, and an Honorary Member of Alpha Nu Sigma. Along with being acknowledged as a Engineering at Illinois Distinguished Alumni Award recipient, his honors include the 2010 NPRE Distinguished Alumni Award, the 2000 Glenn Murphy Award from the American Society of Engineering Education, the 1998 NPRE Outstanding Professor Award, the 1991 Power Engineering Educator Award from the Edison Electric Institute, and the 1982 Halliburton Education Leadership Award.

Jones was so beloved by NPRE alumni that they successfully forged a grassroots campaign to establish a graduate fellowship in his name, with the first Jones Fellow being named in 2010.

Schwartz is new Penn State Engineering Dean

Reprinted with permission from Penn State|News

Pennsylvania State University has named Justin Schwartz, an NPRE alumnus, as Harold and Inge Marcus Dean in the College of Engineering.

Schwartz has served as professor and department head of materials science and engineering at North Carolina State University (NCSU) since 2009. As head, Schwartz brought about a transformative change to the Department of Materials Science and Engineering (MSE), both in numbers and stature, with a firm commitment to faculty excellence and student success.

Under his leadership, the department experienced significant growth in overall faculty numbers, tenure-track additions and successful retentions, as well as under-represented faculty, which increased from 9.5 percent to 30 percent.

Under his tenure, MSE student programs also experienced growth in numbers, with graduate programs doubling and undergraduate programs tripling, and a nearly 20 percent increase in female undergraduates. He also created numerous opportunities for mentoring, professional leadership development, and undergraduate research.

Photo by Ethan Hyman of The News & Observer, Raleigh, North Carolina

Schwartz received his bachelor's degree in nuclear engineering from NPRE in 1985 with highest honors, and his doctorate in nuclear engineering from Massachusetts Institute of Technology in 1990.

Schwartz's research interests include processing-structure-property relationships and failure mechanisms in superconducting materials and systems, multiferroic and magnetic thin films and devices, and optical fiber-based sensors. He focuses on the scientific challenges in transitioning a new material into a technologically functional material. He has published more than 200 peer-reviewed journal articles and has graduated 28 doctoral students in four engineering disciplines and physics.

Burchill honored with ANS Leadership Award

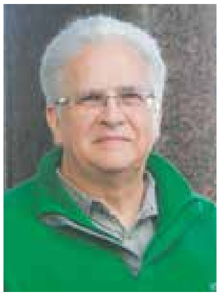
NPRE alumnus William Burchill, past President of the American Nuclear Society, has won the 2017 ANS Leadership Award.

Burchill has been engaged in ANS committees and activities for almost 50 years, including his presidency from 2008–2009. Since 2007, he has supported and advanced ANS goals by representing the society at meetings, conferences and symposia in 24 states and 12 foreign countries, and as a member of the International Nuclear Societies Council which he chaired in 2015 and 2016..

His career has spanned an impactful set of positions in the nuclear power industry at Combustion Engineering, Pennsylvania Power & Light, and Exelon Corp. Many of his contributions have focused on improved nuclear power reactor safety through upgrading safety analysis techniques including probabilistic risk analysis (PRA) and risk management applications at nuclear power plants.

Burchill also has contributed to nuclear academia as an invited lecturer in continuing education courses at several universities and as Professor and Head of the Nuclear Engineering Department at Texas A&M University from 2003-2007. During his tenure at Texas A&M, both the undergraduate and graduate programs rose in the academic rankings. Burchill was influential in encouraging nuclear engineering students at Texas A&M to build their ANS student organization and to enhance their appreciation of the professional values at the earliest stages of their careers.

HERTEL NAMED HEALTH PHYSICS SOCIETY PRESIDENT-ELECT



Nolan Hertel, Professor at the Georgia Institute of Technology and an NPRE alumnus, has been named president-elect of the national Health Physics Society.

An internationally recognized nonprofit scientific organization, HPS promotes excellence in the science and practice of radiation safety. The society's nearly 4,000 members represent all scientific and technical areas related to radiation safety, including academia, government, medicine, research and development, analytical services, consulting, and industry.

As president-elect, Hertel will visit the approximately 40 local chapters of HPS across the country to assess the strengths and weaknesses of the society, as well as the profession of health physics, and make national committee appointments for the following year. He will also assist the HPS president in administering the affairs of the organization, and will automatically take office as president in July 2018.

"I look forward to bringing a fresh perspective to the challenges faced by the Health Physics Society and delivering effective solutions to existing needs," he said.

Hertel has been a member of HPS for over 35 years and has served the society through his participation on the board of directors. In 2016 the society presented Hertel the HPS Distinguished Scientific Achievement Award, recognizing his contributions to the scientific field of radiation safety and for his accomplishments regarding the practice and advancement of the profession of health physics. He is best known for his research concerning neutron spectrometry, neutron interactions, radiation dosimetry, and radiation shielding.

Hertel earned his PhD in NPRE in 1979, then became an assistant professor in the Mechanical Engineering Department at the University of Texas at Austin. In 1993, he moved to the Georgia Institute of Technology as an associate professor in the Nuclear Engineering and Health Physics Program.

VODNIK NAMED TO CRAIN'S CHICAGO BUSINESS TECH 50

NPRE alumnus Craig Vodnik has been named to Crain's Chicago Business 2017 Tech 50 list.

Vodnik co-founded and is vice president of operations of Cleverbridge, which makes e-commerce software that powers digital shopping carts for companies such as Dell and Sony.

He also enjoys mentoring the next generation of entrepreneurs. An investor with Hyde Park Angels, he advises startups through Catapult in Chicago and the University of Illinois' Enterprise Works in Champaign. He often hosts tech community meetups at Cleverbridge in the summer.

Vodnik earned a bachelor's degree in NPRE in 1992.

RECENT GRAD CHOSEN AS ANS NATIONAL STUDENT DIRECTOR

Katie Mummah, May 2017 NPRE graduate, has been chosen as the Student Director of the national American Nuclear Society organization.

Now a graduate student at the University of Wisconsin-Madison, Mummah will represent all student chapter ANS members on the national organization's Board of Directors. "Whatever decision the society makes, the students will have a voice," she said of her new post.

Mummah applied for the office last fall, and appeared before the ANS Student Sections Committee to make a case for her selection. Her name was placed on the ballot and she was elected in the spring.

She demonstrated her leadership abilities as an NPRE undergrad, particularly while serving as president of the ANS student chapter at Illinois during her junior year. Under Mummah's direction in spring 2016, the very active Illinois group brought 53 students to the society's national Student Conference, the most of any university other than the host school, the University of Wisconsin–Madison.

2017 NPRE Distinguished Alumnus John Kotek presents NPRE Leadership Speaker Series talk

John F. Kotek, recent head of the country's top nuclear energy office, presented the 2017 NPRE Leadership Speaker Series talk.

Kotek, current Vice President for Policy Development and Public Affairs at the Nuclear Energy Institute, and former Assistant Secretary of the U.S. Department of Energy Office, Office of Nuclear Energy during the Obama Administration, discussed his views on "The Outlook for Nuclear Energy in the U.S."

Chosen as the winner of the 2017 Distinguished Alumni Award for the Department of Nuclear, Plasma, and Radiological Engineering at Illinois, Kotek covered today's reactors, prospects for new construction, international market opportunities, and the path forward for innovative nuclear technologies. (see npre.illinois.edu/events/leadership-speaker-series)

In his current position, 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 is responsible for providing policy and public affairs leadership on financial, economic, tax, electricity market and environmental issues related to the nuclear energy industry.

President Barack Obama nominated Kotek in October 2015 to serve as Assistant Secretary for Nuclear Energy, following his appointment in January 2015 as Principal Deputy Assistant Secretary. Kotek was responsible for the DOE's research efforts on current and future nuclear energy systems, maintaining the government's nuclear energy research infrastructure, establishing a path forward for the nation's spent nuclear fuel and high-level nuclear waste management program, and a host of other national priorities.

Prior to his appointment, Kotek was Managing Partner of the Boise office of Gallatin Public Affairs, where he advised energy, natural resources and other clients facing complex communication and government relations challenges.

NPRE graduate student Joseph Bottini, right, guides alumni John Kotek, left, and Bill Burchill through a tour of Assistant Prof. Caleb Brooks' laboratory.

From 2010–2012, Kotek served as Staff Director to the Blue Ribbon Commission on America's Nuclear Future. The Commission recommended a new strategy for managing nuclear waste in the United States. Kotek led the development of the Commission's final report to the Secretary of Energy, engaged in regular communications with Congressional and White House staff, and served as media spokesperson.

Kotek earned his bachelor's in NPRE in 1989. He also holds a Master of Business Administration from the University of Maryland.

The Distinguished Alumni Award is presented to NPRE alumni who make notable advances in the field of nuclear science, and/or lasting contributions to society in general. Through their careers and voluntary service, these individuals bring honor upon themselves as well as to their fellow graduates, the Department, the College of Engineering, and the University of Illinois.

The NPRE Constituent Alumni and Industry Advisory Board sponsors the Leadership Speaker Series, which provides a forum for global leaders to present views and policies, particularly those impacting NPRE's disciplines as well as all other issues relevant to energy sustainability.

Double your impact through the new NPRE Visionary Scholarship Fund!

The opportunity to invest in and improve the quality, diversity, and global influence of NPRE undergraduate students has never been greater.

A longtime supporter of the University of Illinois at Urbana-Champaign, The Grainger Foundation has issued a generous Matching Challenge in support of Engineering at Illinois and departments including NPRE. Now through the end of 2019, The Grainger Foundation will match all donations made to the Engineering Visionary Scholarship Initiative, dollar-for-dollar up to $25 million.

Find out how you can help students like Kroeger (below) by contacting Amber Lannert, Director of Advancement for NPRE, at alannert@illinois.edu, or Ross Williams, Assistant Director of Advancement for NPRE, at rwilli@illinois.edu, or by visiting the Engineering Visionary Scholarship Initiative's website, visionary.engineering.illinois.edu/.

The NPRE Engineering Visionary Scholarship Fund campaign has the enthusiastic support of NPRE's Constituent Alumni and Industry Advisory Board. If you would like to talk with one of our board members about how you can get involved, please contact Susan Mumm, s-mumm@illinois.edu, and she will make your connection!

Corporate gifts to engineering scholarship endowments will also be included and matched by The Grainger Foundation.

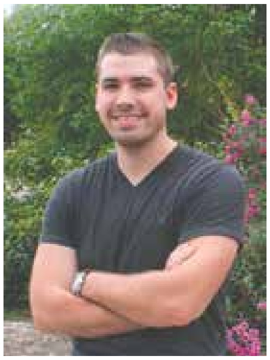
NPRE EVS SCHOLARS

NPRE EVS scholarships assist with recruiting and retaining NPRE's best and brightest undergraduate students. Gifts made to the NPRE Visionary Scholarship Fund will benefit students like these:

Jazz Kroeger of Washington, Illinois

"This scholarship allowed me to research more because I do not have to worry about working," said Kroeger, who is finishing his final year in NPRE. "I also can volunteer so I can give back to the community. Later, when I have a job, I will donate back to help some other kid that needs help getting through college. I am a hard-working student and plan on achieving great things." After graduating, Kroeger plans to continue his education at a medical school and hopes to make professional contributions in the field of nuclear medicine technology.

continued on page 46



Kroeger

Patel

Baca

Why Do I Give?

By Robert Penn, BS 77

There is no greater exercise for the human heart than to reach out and help another one up. These words were spoken by the Chancellor at my No. 1 daughter's college graduation in May 2009. It stayed with me, not only because of my daughter but because of how insightful those words were.

This past May marked 40 years from my graduation at the University of Illinois at Urbana-Champaign. That day in May 1977 was a very proud time for all of us especially my parents. My Dad graduated from Illinois as a Medical Doctor, and my Mom would smile, beaming, having a son who was a nuclear engineer.

Bob Penn and family generously support NPRE's EVS fund and in May 2017 offered a five-year pledge to give annually to NPRE. Bob graduated BSNE in the first Undergraduate Nuclear Engineering class, May 1977.

My nuclear engineering undergraduate and graduate level classmates were a small group: solid, reliable, competitive, involved, witty, capable, leading edge, and very smart. Our teachers included Department Chair Dr. Marv Wyman, Prof. Dan Hang, Dr. Felix Adler, Dr. Roy Axford, Dr. Finis Southworth, Dr. Barclay Jones, Dr. George Miley, Dr. A.B. Chilton, Dr. Bernard Wehring, and chemistry's Dr. Philip Hopke, to name a few.

The classroom was in the Nuclear Radiation Laboratory building next to the Railway Wheel Testing Lab, and the NRL included excellent experimental apparatus as NE398 Radiochemistry and NE's Graphite Uranium Source (GUS). Down the street was NRL II with more offices and apparatus. The now de-commissioned TRIGA reactor provided teaching and education, plus wonderful research. It was there Dr. Hopke instructed me in a year-long independent study with Neutron Activation Analysis, and to this day I remember many of the isotopes and energy levels.

"Today I continue to stand amazed at the knowledge, the backgrounds, the teaching experiences we received."

The teachers were incredibly remarkable. At that time, Engineering at Illinois ranked third or fourth in the nation. Today I continue to stand amazed at the knowledge, the backgrounds, the teaching experiences we received. Only if you asked would they tell some of their backgrounds, including their place as a first account in the history of the Atomic Age. Some of us became good friends with the professors. For example, I worked on car engines with Marv Wyman. For me the gift included a great friendship with Felix Adler and Dan Hang that continued well past graduation.

As an undergraduate success was measured by grades and application. My BSNE degree placed me in an advanced competition that stood the test of time. Today my view of success is all four of our children: each has the positive integrity of their Grandparents, each attended their respective universities, three have college degrees. Today my view is in a smile that as an undergraduate we had such a wonderful series of professors and experiences. We found a precious period away from studies for me to play competitively in men's soccer and also coach for the girls' soccer intramural dorm team. That team, named Eclipse, went on to be the traveling team, and after some time became the Women's Soccer Team. Today the smile is proud to be Illinois NPRE, and to have the ability and interest in continuing to participate, influence others, and give.

Help support NPRE's students and programs!

NPRE is pleased to introduce to our alumni and friends the College of Engineering advancement professionals who will gladly work with you in supporting the Department. Amber and Ross are the ones to call to answer all your questions on giving to NPRE!

Amber Lannert

Hello! I am a Director of Advancement within the College of Engineering, and am proud to represent the Department of Nuclear, Plasma, and Radiological Engineering. My career path with the University of Illinois just began in the month of September, and I am eager to work with our alumni and donors across the country to fulfill the advancement goals of the Department. It is exciting to be a part of the opportunities that the University and alumni are creating for current and future University of Illinois students.

My career in fundraising began in 1999 with the Muscular Dystrophy Association after I received my Bachelor of Arts degree in psychology from Eastern Illinois University. When I am not working with alumni across the country I am on the go with my husband and three children.

You can reach me by email alannert@illinois.edu, or by calling 217-244-2364.

Ross Williams

Hello! I have the pleasure of representing the Department of Nuclear, Plasma, and Radiological Engineering to our alumni and friends around the country as an Assistant Director of Advancement. I have worked with the Department since January of 2016 and am in constant amazement from the accomplishments I see from our students, faculty, and alumni, with whom I get to interact.

Before joining the University of Illinois, I worked for Millikin University in a similar role. I received my Bachelor of Science degree in secondary education from Bradley University but am originally from out West, growing up in Oregon and Colorado. In my spare time, I enjoy spending my days outside with my wife and two dogs, hiking, or kicking a soccer ball around. I look forward to meeting and working with our alumni and friends in the future, Go Illini!

You can reach me by email at rwilli@illinois.edu, or by calling 217-244-2296.

NPRE EVS Scholars, *continued from page 44*

Dhruval Patel of Hanover Park, Illinois

"I have come a long way. Being a senior at Engineering at Illinois is stressful, yet it is one of few things that I have truly enjoyed. Focusing my studies in Nuclear, Plasma, and Radiological Engineering and on research has never been more rewarding. I thoroughly enjoy what I do. I owe it to our donors. Without the financial help that I received, I would have been working rather than researching. Graduation would have felt more of a burden than a reward."

Adolfo Baca of Addison, Illinois

"I am currently a second year student in NPRE, and continue my career path in modular reactor research. In addition, I continue to be a part of the American Nuclear Society, and have also become involved with the Society of Hispanic Professional Engineers. The future I imagine and work towards would not be possible without your contributions to my education. I will uphold my promise to the committee to use this donation to the fullest, and eventually find a way to give back for this generous gift."

A chance to join Illini basketball rounds out college experience for NPRE freshman

By Mike Koon, Engineering at Illinois Marketing and Communications Coordinator

Editor's Note: This story first appeared in February 2017. In September, walk-on Meagan McNicholas proved herself and gained a scholarship as a member of the Illini women's basketball team.

Meagan McNicholas was a star athlete from a school full of star athletes. The Rochester, Ill., native placed third in the 1600 meters while also a member of the third-place 4x800-meter relay team in the IHSA Class 2A state track meet as a freshman. In basketball, she scored 1,000 points, including 14 in the state Class 3A state semifinal game, helping her team to 2nd place at State. She also played soccer and ran cross country.

"At Rochester, sports are what people do," McNicholas said. "No matter the season, we expect to win."

In high school, McNicholas also had a passion for chemistry and physics, so although she had offers to continue her athletic career at a major university, McNicholas says none of the schools she considered for that pursuit matched the level of academics the aspiring pre-med major was looking for. So upon being accepted into NPRE, she gave up hopes of playing sports at the next level.

McNicholas thoroughly enjoyed her first semester at Illinois, feeling at home in the community of the 40 or so freshmen NPRE students while also pledging to the Gamma Phi Beta sorority.

"I love everything about Illinois," McNicholas said. "Everything I could have wanted out of college has happened."

Except for competing in athletics.

But pieces were moving behind the scenes to make that happen. Rochester football coach Derek Leonard, whose team has won state championships in six of the last seven years, and good friend John Wright, a loyal women's basketball supporter and former Illini football player, collectively contacted Illini women's basketball coach Matt Bollant about the possibility of allowing McNicholas to join the team as a walk-on.

"Coach Leonard had indicated that of all the girls he thought could have excelled in football, Meagan would be the one," Bollant said. "He talked about her toughness and work ethic."

So Bollant reached out to McNicholas to see if she had an interest in joining the Illini and invited her for a weeklong tryout.

"It was clear in about 2 to 3 days that this was going to work," Bollant said. "Her attitude was awesome. She was a strong kid and was going to give great effort."

Her commitment to basketball has also meant missing some lectures while on the road.

"That's hard because this semester it's all new material for me," McNicholas said of her rigorous studies. "But here they want to you to succeed, so everyone has been willing to help and answer questions. I do think the juggling act will prepare me for a career and life because you really have to manage your time to get it all done."

McNicholas chose the radiological track of the major because it satisfies the pre-requisites for medical school. She will likely also graduate with a minor in bioengineering. Having an undergraduate degree in engineering also provides more options should she decide she wants to stay in the medical field, but that ultimately eight years of med school isn't in the cards for her.

Either way McNicholas is glad she has had the opportunity to stay involved in basketball and the coaching staff has been happy to have her.

"Coaching is really enjoyable when you have players like Meagan," Bollant said. "There are days when she will come in and battles with the posts and plays defense for half hour straight, but doesn't always get to play offense. Meagan is happy to do whatever the team needs, which is awesome."

The opportunity to play basketball has rounded out McNicholas' freshman experience. "I guess everything happens for a reason," she said. "This was the perfect storm."

ILLINOIS

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