Nuclear, Plasma & Radiological Engineering
THE GRAINGER COLLEGE OF ENGINEERING

FALL 2021
NEWSLETTER FOR ALUMNI & FRIENDS

A New Era at NPRE

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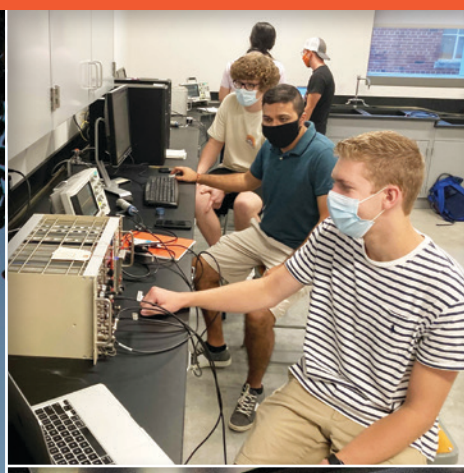

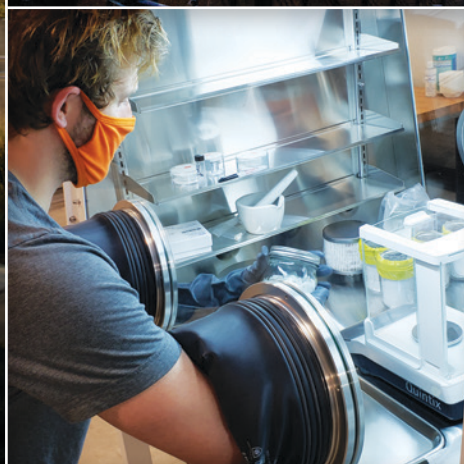

DEPARTMENT OF NUCLEAR, PLASMA, AND RADIOLOGICAL ENGINEERING

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Daniel Andruczyk | research associate professor
Caleb S. Brooks | associate professor
Davide Curreli | associate professor
Angela Di Fulvio | assistant professor
Brent J. Heuser | professor
Kathryn D. Huff | associate professor
Tomasz Kozlowski | associate head, undergraduate programs | associate professor
Ling-Jian Meng | professor
Zahra Mohaghegh | associate professor
Magdi Ragheb | associate professor
David N. Ruzic | professor
Tatsuya Sakurahara | research assistant professor
R. Mohan Sankaran | professor
James F. Stubbins | professor
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NPRE IS EMBARKING ON A NEW ERA, EXPANDING OUR EDUCATION AND RESEARCH OPPORTUNITIES

Rizwan Uddin

Dear NPRE Family,

Another year is underway here, and there is much to be hopeful about. First and foremost, though we are still wearing masks indoors, at least we are back on campus. Students are taking classes and meet with faculty in-person, and that is always a welcome sight. We all can be very proud of the way your alma mater has handled the COVID pandemic.

Secondly, the Talbot Laboratory expansion is complete, and students are now able to use the new *Nuclear Materials* and *Radiation Measurement* labs, along with a great new conference room that the students, faculty and staff can use for meetings and presentations. Due to lingering COVID-related uncertainties, ribbon cutting has been postponed to Fall 2022.

In faculty news, we saw Dr. Katy Huff take a position as Principal Deputy Assistant Secretary (PDAS) in the Office of Nuclear Energy in the U.S. Department of Energy. So far, she has also been serving as Acting Assistant Secretary. We will manage while she is away, but we are looking forward to her return to NPRE in the next couple of years. In the meantime, she has already been promoted to the rank of Associate Professor.

Dr. Daniel Andruczyk has also been promoted, to the rank of Research Associate Professor. In addition to these promotions, we have welcomed Dr. Tatsuya Sakurahara join the faculty ranks as Research Assistant Professor. We also have two new research scientists in Drs. Madicken Munk and Pegah Farshadmanesh.

The future is bright when it comes to our faculty and students. Illinois Plasma Institute (Prof. Ruzic), SoTeRiA Lab (Prof. Mohaghegh), and Radiation Detection and Imaging Group (Prof. Meng), to mention just a few, have seen significant growth in research in the past year. Our student chapter of the American Nuclear Society is preparing to host their national conference here on the UIUC campus this coming April, and our chapter of *Women in Nuclear* hosted their regional conference this past summer. Graduate students have formed a *Graduate Student Advisory Committee* which will work closely with the department on matters that impact graduate students.

I would be remiss if I did not mention the loss our department earlier this year suffered with the passing away of Dr. Roy Axford, who served NPRE (and the world) for decades. He was a pioneer in nuclear and an inspiration to me and so many others, and he will be sorely missed.

Lastly, I want to recognize our alumni, who have been steadfastly by our side and lifting us up in so many ways. Their gifts and contributions have been invaluable in helping NPRE continue to improve and helping students afford to attend our great university. We are grateful that so many alumni support the mission of NPRE.

With that, I invite you to explore these pages and to regularly visit our website and social media to stay up to date on NPRE's forward march.

Sincerely,

Rizwan Uddin

"The Talbot Laboratory expansion is complete, and students are now able to use the new *Nuclear Materials* and *Radiation Measurement* labs, along with a great new conference room that the students, faculty and staff can use for meetings and presentations."

NPRE PROFESSORS RANKED AS "EXCELLENT" BY THEIR STUDENTS

Fall 2020

Davide Curreli
David Ruzic
William Roy
Rizwan Uddin

Spring 2021

David Ruzic
William Roy
Rizwan Uddin

Contents

GROWTH

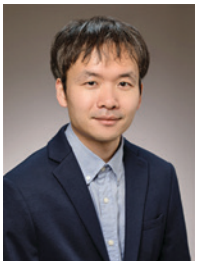
Andruczyk promoted to research associate professor

This fall, Dr. Daniel Andruczyk was promoted to Research Associate Professor. Andruczyk has been with NPRE as a research assistant professor since 2014, after stints as a postdoctoral researcher and research engineer. He currently heads up the Hybrid Illinois Device for Research and Applications (HIDRA) and leads the Master of Engineering in Plasma Engineering program at UIUC.

"Being promoted to Research Associate Professor is extremely satisfying," Andruczyk said. "It is the acknowledgement of all the hard work that has been done over the years to get HIDRA up and running and helping to elevate the U of I as a world leader in plasma technology and nuclear fusion. It's allowed us to be a leader in the national liquid metal PFC development program. This is all possible because of the wonderful students, colleagues, staff and friends within the department and university that have encouraged and supported me. As I start the next chapter of my career, I am looking forward to elevating NPRE and UIUC further as a world leader in plasma and fusion technologies."

"We are proud to have Dr. Andruczyk in NPRE," department head Rizwan Uddin said. "His work has bolstered our presence in the plasma engineering world, and we are excited to have him continue to grow with us."

Sakurahara promoted to research assistant professor



Dr. Tatsuya Sakurahara is now a research assistant professor in NPRE, thanks to a recent promotion. Sakurahara holds a PhD in Nuclear, Plasma & Radiological Engineering from UIUC and is the chief scientist in NPRE's Socio-Technical Risk Analysis (SoTeRiA) Research Laboratory.

Sakurahara came to the University after earning his BS and MS degrees from the University of Tokyo. His Ph.D. research developed an Integrated Probabilistic Risk Assessment (I-PRA) methodological framework for Fire PRA of nuclear power plants by coupling a computational fluid dynamics (CFD) fire model with a human performance model for fire crew and integrating the fire-human coupling with the plant PRA model.

Illinois Plasma Institute expands its space in Research Park

As the new school year gets going, the Illinois Plasma Institute is continuing to grow.

The IPI, located in the University of Illinois' Research Park, has purchased more space in its building and is making room for more equipment and experiments.

A quick walk through the facility on Oak Street shows a place where important work is happening during a time of expansion and renovation. "Each of the companies working here is so excited about the opportunities, that they want to bring more projects and people," said David Ruzic, Abel Bliss Professor of Engineering in NPRE and the IPI's director. "We need more room to do the work."

There are currently three companies working with the IPI. LytEn, a California-based company that focuses on applying Silicon Valley technology to carbon, was the latest to join up with the IPI earlier this year.

LytEn joined Tokyo Electron Limited (TEL), an electronics and semiconductor company, and Tokyo Ohka Kogyo Co., Ltd. (TOK), a Japanese chemical company specializing in micro processing technology, as partners with IPI. TEL is one of the three companies worldwide that make etching and deposition equipment for the semiconductor industry. TOK works with photolithography in producing photo resist chemical solutions that clean microchips after they have undergone plasma etching.

As for who is working in the IPI space, there are currently six graduate students, eight undergrads, and four new MEng in Plasma Engineering students who are company employees in the building. "That's the big benefit of IPI," Ruzic said.

The majority of the latest renovations are expected to be completed by the end of August. Work on some specialized areas will continue into the fall. "The synergy between the companies and our researchers is fantastic," Prof. Ruzic said. "As we attract more partners, we will need even more space. This renovation will not be our last!"

Collaborative relationships: *Getting to Know Dr. Madicken Munk*

Dr. Madicken Munk is NPRE's newest research scientist.

She has previously worked as a post-doctoral researcher on campus at the National Center for Supercomputing Applications (NCSA). Before coming to UIUC, Munk received her BS in Nuclear Engineering from Oregon State University and her MS and PhD from the University of California, Berkeley.

As she starts this next phase of her academic career, here is a short Q and A on her background.

What is your hometown?

I grew up in a suburb of Minneapolis, Minnesota. I love the cold Midwestern climate, so I feel right at home in Champaign-Urbana.

What inspired you to study nuclear engineering?

My favorite subjects in high school were math, physics, and chemistry. I was fascinated by a small unit on nuclear technologies that we were taught in my physics class. During my college search, I found myself drawn to the nuclear departments that I visited. I felt immediately included, and all of the students I met were so passionate about their work.

What brought you to Illinois?

My doctoral research primarily centered on developing hybrid methods for radiation transport, which is a computationally focused topic… As I was finishing my degree, I interviewed for a position in the Data Exploration Lab at the National Center for Supercomputing Applications at UIUC getting to work on yt, a Python package for data exploration, analysis, and visualization of computational simulations. I've been at NCSA ever since and I've enjoyed building up my computational toolbox to make my nuclear engineering research more versatile, flexible, and creative.

What are you looking forward to in your new role at NPRE?

I am really looking forward to building collaborative relationships in the NPRE department and doing exciting work on advanced reactors and fuel cycles. The students in the ARFC research group are vibrant and inspiring, and I am honored to be able to work with such bright, curious people.

What are your favorite pastimes outside of the office/lab?

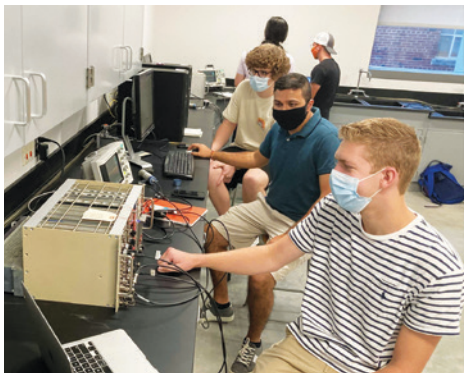
I love exploring the parks of Urbana-Champaign—and maybe even going for a swim if there's water! I have a very cute cat that I really like to tease and take pictures of. I'll confess that the majority of my camera roll is filled with pictures of my cat. I also love curling up with a good book and cup of coffee (and my cat).

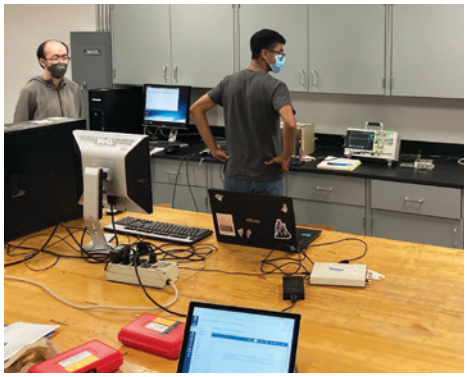
New labs and facilities usher in new era at NPRE

Talbot Laboratory has been in the middle of a construction frenzy over the past few years.

One of the projects, an addition to Talbot's southside, offers NPRE students state-of-the-art instructional laboratories in radiation measurements and nuclear materials and gives the department a new conference room.

New classrooms for NPRE students and other majors in The Grainger College of Engineering have begun in the 122,000-square-foot Campus Instructional Facility built just north of Talbot. And, to the east of Talbot, on the John Bardeen Quad, campus researchers have installed a geothermal monitoring well.





"The **Radiation Measurement Lab** currently hosts several pieces of equipment and experimental setup used in NPRE 451, including gas, semiconductor, and scintillation detectors, as well as multichannel analyzers and fast digitizers. This equipment allows students to experimentally demonstrate fundamental radiological concepts: radioactive decay, Compton scattering kinematics, and radiation penetration depth are just a few examples. Students in 451 have the opportunity to experimentally verify many of the concepts that are explained in class in theory through nine different lab experiences and an 'open' lab, where students entirely design and perform an experiment of their choice. Starting from Spring 2022, we are going to offer an Advanced Radiological Science lab, including new and exciting experiments, such as the demonstration of various stand-off radiation imaging principles, the use of positron annihilation lifetime to characterize materials, and the measurement of multiplication and fragment energy loss from fission."

—Assistant Professor Angela Di Fulvio

"The new Talbot addition houses an **undergraduate materials laboratory** that will allow the department to expand and improve the teaching experience related to experimental nuclear materials. The laboratory contains three fume hoods that will allow for wet chemistry and a glove box for the storage and manipulation of air and moisture sensitive materials. Mechanical cutting and polishing equipment are available for sample preparation. The laboratory also contains a Zeiss Axio Scope with bright field, dark field, and differential interference contrast modes up to 300x magnification. Over the next few years, we will transition some of the experiments performed in NPRE 432 to the new laboratory."

—Professor Brent Heuser

Huff appointed to US Department of Energy leadership role

BY SHARITA FORREST, ILLINOIS NEWS BUREAU

Earlier this year, NPRE associate professor Kathryn D. Huff accepted an appointment to a senior leadership position in the U.S. Department of Energy, Office of Nuclear Energy.

As principal deputy assistant secretary for nuclear energy, Huff oversees the five deputy assistant secretaries and the agency's activities in areas such as nuclear facility operations, science and technology innovation, and international nuclear energy policy.

Huff has also taken on the title of acting assistant secretary of the Office of Nuclear Energy. "The world is at war with climate change," she said in May. "It's my honor to be called to serve the Biden-Harris administration in this fight. In this position, I hope to work with other offices in the U.S. Department of Energy—such as the Office of Energy Efficiency and Renewable Energy and the National Nuclear Security Administration—to help nuclear power maintain its role as a key part of the world's clean energy future.

"It will be a unique opportunity to advance new reactor deployments, encourage rational national fuel cycle strategies and help consent-based waste management policy move forward."

Huff holds a bachelor's degree in physics from the University of Chicago and a doctorate in nuclear engineering from the University of Wisconsin, Madison. She joined the U. of I. engineering faculty in 2016 and has received campus and departmental awards for teaching excellence. Her research interests include scientific computing education, repository system performance modeling, and reactor neutronics and kinetics.

"We never expected anything less from Professor Huff," department head Rizwan Uddin said. "She is respected, well-known and well-liked by the nuclear and computational science communities. Though we will miss her expertise and wit while she is gone, I am happy to see that she will be serving the country, and the broader community will benefit from her experience. Her impact will be far-reaching with a long half-life."

Micro-reactor project continues pace toward becoming a reality

A potential nuclear reactor returning to the University of Illinois campus is still a long way away, but the project continues to move forward.

Over the summer, UIUC submitted a Letter of Intent to the U.S. Nuclear Regulatory Commission (NRC) to apply for a license to construct a research and test reactor facility on the UIUC campus. The submission of the Letter of Intent was the first step in NRC's two-step process to license a new reactor, including a process of public hearings on the proposed project for full transparency. The first of those meetings was held in October.

The University's Grainger College of Engineering (and its Department of Nuclear, Plasma, and Radiological Engineering), in collaboration with Ultra Safe Nuclear Corporation (USNC), is spearheading the new reactor deployment.

The next steps include submitting a Regulatory Engagement Plan soon to the NRC and having a formal Memorandum of Understanding in place with USNC.

NPRE's efforts are led by associate professors Caleb Brooks and Tomasz Kozlowski, with assistance from Professor Jim Stubbins. Recently joining the project are Clive Townsend, who served as a supervisor for Purdue University's reactor, and NPRE adjunct professor William Roy, an expert in nuclear waste management. The department also has a large cohort of undergraduate students working on the activities necessary for an environmental review.

The new research and test reactor facility will offer UIUC staff and students a diverse set of opportunities for research: instrumentation and control (I&C), multi-physics validation, reactor

prototype testing, micro-grid operations, cybersecurity, hydrogen production for transportation and energy storage, and other energy intensive, high-value products.

"Students and researchers will learn at the cutting edge of advanced clean energy technologies, and the integration of those technologies," Brooks said.

Read the rest of the story at ***npre.illinois.edu/news/stories/micro-reactor-update-nov21***.

Sankaran settling in at MRL with 'so many resources'

At this time last year, Professor Mohan Sankaran was still in the beginning of his acclimation period in NPRE. While he admits he's still adjusting to life in Champaign-Urbana, that adjustment now includes new lab space in the Materials Research Laboratory.

"My goal in coming here was, number one, to come to a department that was much more focused on plasma," Sankaran said. "I came from a department in chemical engineering (at Case Western Reserve University in Cleveland, Ohio) where I was the only one working on plasmas. Even beyond that, there was no plasma department on campus."

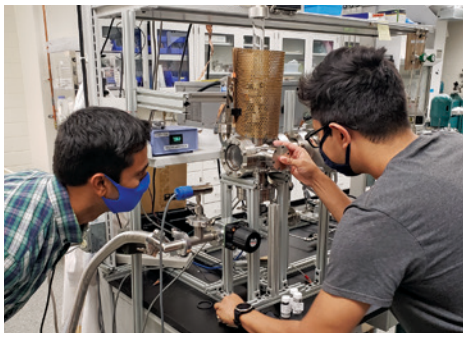
Here at Illinois, Sankaran inherited his current lab spaces from Prof. J.P. Allain, now the nuclear engineering department head at Penn State University.

He's also inherited the use of IGNIS (Ion-Gas-Neutral Interactions with Surfaces), a state-of-the-art *in-situ* experimental surface science facility capable of characterizing surface materials under extreme conditions.

IGNIS is able to expose surfaces to a collection of energetic particles under high-pressure and high-temperature environmental conditions *during* surface analysis measurements. The device allows x-ray photoelectron spectroscopy, ion-scattering spectroscopy, and Raman spectroscopy in a single chamber.

Sankaran says that IGNIS is a smaller-scale machine than HIDRA "that can take a surface and can expose it to the type of species that you would find in a fusion reactor and do it in a separate, controlled environment. It also has something unique on it, which is this tool which can analyze the chemical composition of a surface as it's being treated."

His research group makes their own materials for different technologies. "We grow thin films for electronic application," Sankaran said. "We also make materials that can be used as a catalyst, that can



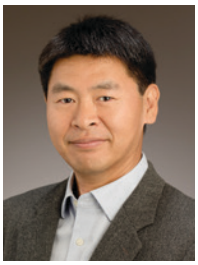
be used in an energy device. A lot of the materials are relatively new.

"If a material is going to be used in some environment and that environment could change its properties, we can study how that material could change by using this machine."

Though the pandemic has made meeting people and getting access to everything in person a difficulty, Sankaran says he is happy with the inroads he has made so far.

Read the rest of the story at ***npre.illinois.edu/news/stories/sankaran-mrl***.

Meng awarded seven-figure grants to continue imaging advances



NPRE professor Ling-Jian Meng has received grants totaling over $6 million for projects that will further his industry-leading research in imaging.

The first project is a $3.8 million Biomedical Research Partnership (BRP/U01) grant from the National Institute of Biomedical Imaging and Bioengineering (NIBIB), entitled "High Energy and Spatial Resolution Multi-Isotope SPECT imaging of Targeted Alpha-Emitters and their Daughters."

The overarching goal of this project is to develop the next-generation clinical SPECT imaging platform (which will be referred to as Alpha-SPECT) that incorporates cutting-edge CZT imaging spectrometers and a synthetic compound-eye (SCE) game-camera design to offer a dramatically improved spatial resolution, energy resolution, sensitivity, and multi-isotope imaging capability and apply the Alpha-SPECT technology to accelerate the development and translation to the clinical practice of α-particle radiopharmaceutical therapeutics (αRPTs).

The second grant is $2.5 million from the National Institute of Biomedical Imaging and Bioengineering (NIBIB) for a project entitled "Hyperspectral Single Photon Imaging" that has the potential to transform molecular imaging techniques for both preclinical and clinical imaging applications.

The emphasis of this research project is to develop a spectral imaging technique that utilize the latest CdZnTe (CZT) semiconductor imaging detectors to pick up gamma-ray signatures of multiple radiotracers based on their distinct (energies) wavelengths. This development could transform typical nuclear medicine, such as SPECT and PET that typically produce single-function, monochromatic images into multi-color imaging modalities that can simultaneously visualize multiple molecular processes in a given individual, which would greatly expand the capability of nuclear medicine in diagnostic and therapeutic applications.

Both projects are collaborations with Meng's lab here at UIUC (which includes new space in the Digital Computer Laboratory) and colleagues at Johns Hopkins University in Maryland.

Pass the salt: Machine learning accelerates molten salt simulations for nuclear power applications

BY JENNA KURTZWEIL, BECKMAN INSTITUTE

Throw it over your shoulder, add it to mashed potatoes, sprinkle it on a wintry sidewalk—salt is ubiquitous in our daily lives. Scientists speculate that going nuclear may be next.

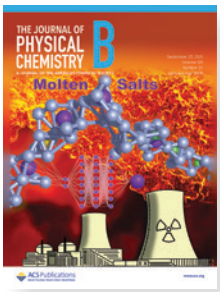
Shao-Chun Lee, a graduate research assistant at the Beckman Institute for Advanced Science and Technology, led a team that used advanced machine learning to model the physico-chemical properties of a molten salt compound called FLiNaK.

The team's computer framework can help characterize and screen other molten salts, too, ultimately answering the question: "Which molten salt is the best to use in a nuclear reactor?"

The paper is published in *The Journal of Physical Chemistry B* and featured on its cover.

Nuclear power—and its potential to replace nonrenewable resources like fossil fuels—has captured the attention of engineers, chemists, and energy scholars.

"All energy sources we use ultimately come from nuclear. Even solar power comes from nuclear fusion," said Yang Zhang, who goes by YZ, the study's lead investigator and an associate professor of nuclear, plasma, and radiological engineering and electrical and computer engineering at the University of Illinois Urbana-Champaign. "Nuclear energy is an indispensable part of the clean energy solution and a pivotal piece in tackling climate change."



Molten salts, or salts so hot that they become liquified, can conduct large amounts of heat—a superpower needed to function in a nuclear reactor's extreme environment. And that's exactly what scientists have in mind. So-called "molten salt reactors," not yet commercialized, can use molten salt as both the coolant and nuclear fuel. They are widely understood to be more efficient and safer than conventional light-water reactors.

"We want to design reactors that are inherently safe," said YZ, who is also a UIUC Donald Biggar Willett Faculty Scholar. "The properties of molten salt offer major advantages in safety and efficiency."

Their capacity for thermal energy storage also has applications outside of nuclear energy; for example, storing solar power for use at night, in inclement weather, or during the darkest winter months.

Read the rest of the story at ***go.npre.illinois.edu/molten-salt***.

Highlights from the Socio-Technical Risk Analysis (SoTeRiA) Research Laboratory

Mohaghegh appointed to National Academies committee

NPRE Associate Professor Zahra Mohaghegh has been selected to serve as a member of a year-long Committee on *Transport Airplane Risk Assessment Methodology* of the U.S. National Academies of Sciences, Engineering, and Medicine. This study will assess the risk assessment methodology used by the Federal Aviation Administration (FAA) under the overall safety oversight system. The FAA uses the Transport Airplane Risk Assessment Methodology (TARAM) to quantify potential risks in currently operating airplanes and to inform FAA decision makers regarding corrective actions to prevent accidents.

Mohaghegh featured in *Nuclear News*

Mohaghegh was also featured in the "Leaders" section for September issue of *Nuclear News* magazine from the American Nuclear Society. Her article, "Lighting the Path for Next-Generation PRA Leaders in Nuclear Engineering," highlights Probabilistic Risk Assessment (PRA) educational and research gaps and proposes urgent actions to be taken by academia and government agencies to prepare next-generation PRA leaders for achieving short- and long-term nuclear energy goals.

SoTeRiA Laboratory received two grants from NRC and DOE

The SoTeRiA Research Laboratory received two grant awards in 2021. The first grant ($500,000; 2021–2024) is from the Nuclear Regulatory Commission (NRC) for "Advancing Uncertainty Analysis Processes in Risk-Informed Regulatory Framework to Support Simulation Approaches for Aging Plants and Advanced Reactors." The second grant ($800,000; 2021–2024) is from the U.S. Department of Energy (DOE) Nuclear Energy University Program (NEUP) to develop a "Probabilistic Validation and Risk Importance Ranking Methodology for Automation Trustworthiness and Transparency in Nuclear Power Plants."

Remembering Dr. Roy Axford

After the March 2021 passing of Dr. Roy Axford, we asked alumni, faculty, and staff to share their favorite memories of Prof. Axford. Here are some of them.

My sincere condolences to the immediate and extended family members of Professor Roy Axford. Prof. Axford was my NPRE doctoral thesis supervisor from 1998 to 2001. I first got to know him in 1995, when I started taking graduate-level courses in nuclear engineering that he taught.

For me, his approach was more "hands off," but he would provide assistance and guidance as needed. I am reminded of an idea or approach to things that he recommended...along the lines of "if you don't understand things at first, that's okay . . . just go and spend more time thinking about the problem." Professor Axford certainly encouraged me to spend the time to ponder and think about a problem...rather than rushing to find a solution immediately. That has been very good advice.

—Blair P. Bromley, PhD '01, M.Sc. (Aerospace) '98

He was a fine human being, an exceptional educator, and a sharp intellect. He set a high bar for me.

—Glenn A. Carlson, JD, PhD UIUC: BSNucE '79, MSME '83, MSNucE '83

Dr. Axford was and still is my favorite professor from my college days... He is the only person I know who could walk into a classroom, without notes, and start deriving equations four blackboards long for hours on end. . . Not only was Dr. Axford extremely intelligent and gracious to his students, but he was kind, patient, and thoughtful . . . I feel so blessed to have had Dr. Axford as a professor, and he and his family will be in my prayers.

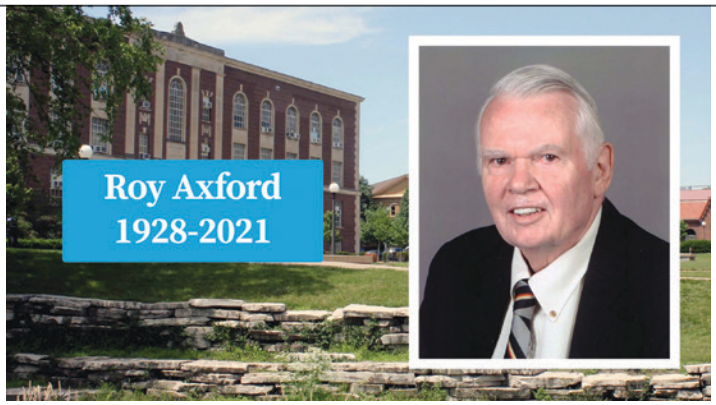
—Kendra M. Foltz Biegalski, PhD, P.E.

When I interviewed so many years ago, Roy took me out to dinner—we both were from Detroit originally. We spent three hours talking about the many experiences we shared of the city and higher education. I also sat in on one of his lectures on reactor physics and perturbation theory during that interview—he was a skilled teacher, something the students in that class understood.

—Brent Heuser, NPRE professor

I was always amazed at his knowledge, quiet countenance and his hand-written class notes. I truly admired him for what he meant to all his students, and the looks of devotion that would come over their faces when talking about him. He was one of a kind and there will NEVER be another Professor Axford.

—Gail Krueger



Roy was my thesis advisor in 1979. While I had the opportunity to continue on for a PhD with Roy, I decided to complete my education with a Masters. I have always been extremely grateful to Roy that this did not prevent him from offering me funding to finish my thesis as a graduate research student at Los Alamos National Laboratory. Not all professors would have taken the time and interest in a student who was not continuing in the program.

—Steve Hatch, BS '78, MS '80

Dr. Axford was truly a brilliant man. He could fill a chalkboard with equations from memory faster than students could take notes. He took a lot of pride in his work, in the classes that he developed and taught, in his research and lineage of students who he mentored... He held himself and our students to high expectations, but he acknowledged with pleasure when they did well. He was unassuming and modest with a humor that sometimes snuck up on you unexpectedly . . . He made a definite impression and impact on the many students who were fortunate to have him as a teacher and on his faculty colleagues and staff who worked with him.

—Becky Meline, NPRE Senior Coordinator of Academic Programs and Academic Advisor

*Dr. Axford was my PhD advisor. I got my degree in 1970. He was a **great** teacher—one of a handful who I have had over the years. As a thesis student, I will always appreciate how he fostered independence. He was available for advice, but never controlling. He will be missed.*

—Paul Rohan, PhD '70

He was an inspiration. As I wrote at the time of his retirement, I am one of the countless students who have been inspired by his lecturing style, and his total mastery of the range of subjects covered by our curriculum.

—Rizwan Uddin, NPRE Professor and Department Head

I was not impressed by Professor Axford's lecture at first. I had a hard time understanding his handwriting and his speaking was so gentle that it seemed that the words remained in his mouth. However, soon I learned that he was a walking integral calculator who performed magic tricks by giving lectures with chalks alone . . . He showed me grace, and I learned how much it meant to a student.

—Hsingtzu Wu, MS '11, PhD '13

ANS chapter thrives during pandemic, preps for national conference

Taking classes during a pandemic is tough.

Try adding running a student organization in between those classes. Like most, if not all, student organizations on the UIUC campus, the American Nuclear Society had to follow careful COVID-19 guidelines during the 2020-21 school year and met mostly online and kept things virtual.

"We had to adapt a lot of our events to be online so everyone could stay safe," current chapter president Anna Balla said. "I think, in comparison to a lot of student organizations, we remained really strong. We had decent recruitment last year, created an entire Discord server (we didn't have one before), which brought a little gaming to our chapter.

"(We) kept (weekly) happy hours, but virtually, so we could see each other on a regular basis, and we did a lot of advocacy instead of our normal outreach stuff."

Earlier this year, as more and more people were able to get vaccinated and meeting rules were relaxed, ANS members were able to meet in person with increased regularity. "We could still see each other, wear masks, and meet safely while keeping our community going," vice-president Dilan Kurukulasuriya said. "I think a good sense of community keeps everybody going. We're good about making things happen, whether it's social events or outreach events."

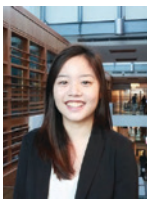
For the full story, go to ***npre.illinois.edu/news/stories/ans-fall-2021***.

New committee gives graduate students a voice

Earlier this year, NPRE's graduate students formed the department's first Graduate Student Advisory Committee (GSAC). We asked each current member to discuss why there are serving on GSAC and what each member believes it brings to grad students and the department.

AMANDA BACHMANN (TAMPA, FL)

"I am serving on GSAC because it gives me a chance to resolve issues that I see in the department, make the department better for future graduate students, and organize events to bring all of the graduate students together."



GWENDOLYN CHEE (SINGAPORE)

"I am serving on GSAC because NPRE grad students deserve to have a committee that prioritizes their wellbeing, happiness, and community. Well-supported and happy grad students result in better research and more recognition for NPRE!"

CARLY ROMNES (DULCE, NM)

"Serving on the NPRE GSAC has been a great opportunity to improve our department and help identify how we can best support our graduate students and strengthen our graduate student community, as well as improve our sense of community and mental health."

ANDREW SHONE (SAINT CHARLES, IL)

"The creation of GSAC has allowed students to easily provide their unique perspectives on department issues. The thing I enjoy most about serving on GSAC is when we implement our solutions to issues and see an immediate positive impact on graduate student life."

MATTHEW WEISS (VERNON HILLS, IL)

"GSAC has allowed me to get to know many other graduate students across the different disciplines, as well as created an opportunity to improve upon the graduate student life in our department. I believe that being on GSAC has helped me to view department issues from a different perspective, and, using all our combined views, we can find solutions to common issues. GSAC brings an opportunity for other graduate students in the department to have their thoughts heard, and then we on GSAC can either communicate those concerns to the department, or we can discuss and come up with our own unique solution."

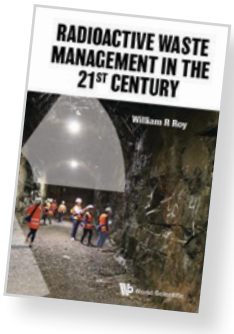
Roy pens new textbook on radioactive waste solutions

An old proverb says that necessity is the mother of invention.

For NPRE adjunct professor William Roy, his own lecture notes and the changing times led to the publication of his new textbook, Radioactive Waste Management in the 21st Century.

"I started teaching NPRE 442 (Radioactive Waste Management) in 2008," Roy said. "I began using a textbook for the course that was helpful, but I also began to write detailed lecture notes. With time, the notes became handouts to the students, then they evolved in book chapters.

"I saw the need to create a new textbook that emphasized geology and chemistry. As the scope of the project grew, I also wanted to have material about uranium and decommissioning included. I saw the need to have an international perspective on waste management. My experiences in Sweden inspired me further."



The intended audiences for this textbook are undergraduate and graduate students in science and engineering, college-level faculty, attendees at waste-management training courses, Federal and commercial waste management/site remediation staff, environmental consultants, and waste management personnel in the military. At the end of each chapter are review questions that are intended to make this textbook ready for immediate classroom use.

"The safe management of radioactive wastes is of paramount importance in gaining both governmental and societal support for nuclear energy. This new textbook provides a comprehensive perspective on all types of radioactive wastes as to how they are created, classified, characterized, and disposed. We know how to manage radioactive wastes, but we need to better educate the public."

Roy said he plans to use this book in his Radioactive Waste Management classes and is considering using it for his new course, Decommissioning Nuclear Facilities (NPRE 498).

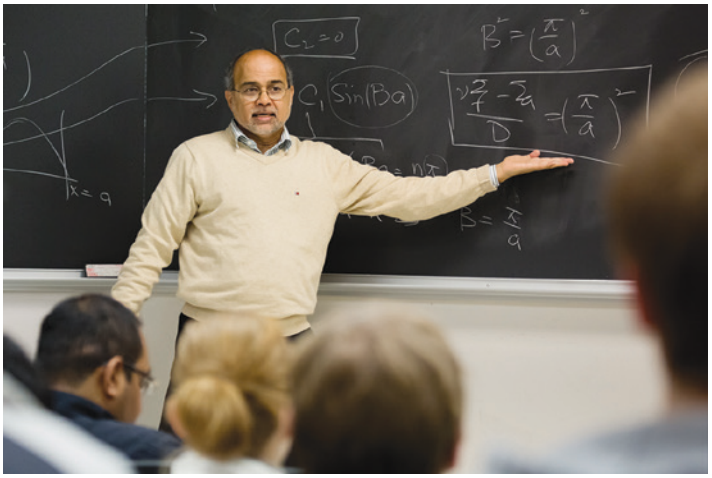
Uddin "honored and humbled" to win ANS Don Miller Award

NPRE professor and department head Rizwan Uddin was recently named this year's winner of the American Nuclear Society Don Miller Award.

The Don Miller Award recognizes outstanding engineering, research and development, licensing or project achievements in the fields of nuclear instrumentation, control and human-machine interface technology from around the world.

"I am honored and humbled by my selection for the Don Miller Award," Uddin said. "I thank the nominators and the selection committee. Much of the credit for any such award goes to the students who contributed equally, if not more. I share this award with them."

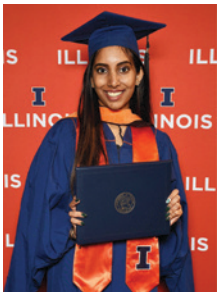
The award was established by the ANS Human Factors, Instrumentation & Control Division (HFICD) in 2009. It is named after Dr. Don W. Miller, Professor and Distinguished Program Chair at the Ohio State University Nuclear Engineering Program, a prior member of the Advisory Committee on Reactor Safeguards, and past ANS President.



Prof. Uddin has won many awards in his time at UIUC. Most recently, he was named the 2020 winner of The Grainger College of Engineering's Teaching Excellence Award and the 2018 winner of the Campus Award for Excellence in Graduate & Professional Teaching.

Energy Systems degree brings two recent grads together at same company

Two people from different backgrounds, brought together by a common (yet uncommon) degree, and now, a common workplace.



The paths of Sanjana Kartik and Sonia Chandrasekharan have converged at Chicago-based energy company Invenergy.

Kartik, a native of Toronto, Canada, came to the University of Illinois to pursue a Master's degree in Energy Systems after getting her undergraduate degree from the University of Waterloo.

"I stumbled upon the Energy Systems website when I was searching for grad programs and found it to be the perfect match for my interests," Kartik said. "The Energy Systems degree opened me up to experiences, gave me access to a network and provided me with the basic skills to speak about all things renewable. This was highly valuable for me as a recent graduate entering the industry."

Chandrasekharan grew up in Penang, Malaysia and moved to the United States in 2014 to attend the University of Wisconsin, Madison before coming to UIUC.

"I have always been very interested in the study of renewable energy," she said. "While pursuing my undergraduate degree in Materials Science and Engineering, I also obtained a Certificate for Engineers in Energy Sustainability. After two years of being in the workforce, I decided to go back to graduate school to pursue my interest in the renewables field.

"This degree gave me first-hand experience in designing and implementing large-scale solar, wind and energy storage systems. This experience undoubtedly helped me in landing this position at Invenergy."

Now, both Kartik and Chandrasekharan are both at Invenergy, using the skills acquired in their Energy Systems degrees to work on renewable energy solutions in a world that needs them now more than ever.

> "The Energy Systems degree opened me up to experiences, gave me access to a network and provided me with the basic skills to speak about all things renewable."
>
> —*Sanjana Kartik*

"I had done an internship with First Solar in utility scale solar while I was at UIUC and loved it," Kartik said. "I learned a lot about development but never got the chance to have a project for myself. I met folks from Invenergy during a conference that the program sponsored me to attend. After graduation, I ended up in commercial scale solar but always wanted to come back to utility scale solar. That's when I turned back to Invenergy in search of open roles."

For the full story, go to ***npre.illinois.edu/news/stories/sonia-sanjana***.

CURRICULUM REVISION SET TO BEGIN IN 2022

NPRE has proposed a revised curriculum to maximize learning and experiences on campus and continue to build the best education for students.

The proposed curriculum revision:

- Adds new courses
- Modifies content of existing courses
- Strengthens mathematics requirements
- Brings uniformity to the three professional concentrations by
  - Added 300-level introductory courses
  - Advanced laboratory for radiological concentration
- Implements a NPRE Technical Core GPA requirement

New NPRE Courses: New required courses are added to eliminate deficiencies in the current program related to math, heat transfer, and advanced lab experiences.

- NPRE 200 Mathematics for NPRE (2 Hrs.)
- NPRE 321 Intro to Plasmas & Applications (3 Hrs.)
- NPRE 330 Materials in Nuclear Engineering (3 Hrs.)
- NPRE 349 Intro to NPRE Heat Transfer (2 Hrs.)
- NPRE 452 Adv Radiological Science Lab (2 Hrs.) (Radiological concentration)

Revised courses: Existing courses are revised to eliminate redundancy, bring content in line with expected levels, and more efficient content delivery.

- NPRE 445 Interaction of Radiation with Matter (4 Hrs.) (previous NPRE 446/447 6 Hrs.)
- NPRE 449 Nuclear Systems Engineering & Design (3 Hrs.) (Previous NPRE 448 4 Hrs.)
- *Additional revisions*:
- MATH 257 Linear Algebra with Computational Applications (3 Hrs.) required.
- TAM 335 or ME 310 (4 Hrs.) required (previously not required for Radiological concentration).
- ECE 206 Electrical and Electronic Circuits Lab (2 Hrs.) deleted.
- PHYS 214 Quantum Mechanics (2 Hrs.) deleted.
- NPRE 421 Plasma and Fusion Science required only for Plasmas concentration
- NPRE 431 Materials in Nuclear Engineering renumbered to 330. 430 Adv Materials in Nuclear Engineering becomes an elective for Power concentration.
- NPRE Technical Core GPA Requirement—TGPA ≥ required in NPRE 200 and NPRE 247.

David Neil Ruzic Undergraduate Scholarship established for students who work and play hard

NPRE is proud to announce the endowment of the David Neil Ruzic Undergraduate Scholarship, in honor of Professor David Ruzic, a fixture in NPRE for over three decades.

Funded through generous time and monetary contributions from former CPMI (Center for Plasma-Material Interactions) graduates, employers, institutions, friends and family, the David Neil Ruzic Undergraduate Scholarship is to be awarded annually to a 2nd or 3rd year NPRE student.

The student must exemplify the undergraduate experience to pursue "hands-on" applied research experiences, embody the signature "Work Hard, Play Hard" mentality, and be both responsible and proactive to "create" opportunities for success.

"Beginning with the end in mind, over 30 years ago, David recognized the value in providing tangible 'hands-on' plasma, modeling, and materials experiences to undergraduates, including exposure to the R&D discovery process, embedding with a graduate student/post-doc team, and interacting with academic, laboratory and industrial stakeholders," said Brian Jurczyk, President/CEO of Starfire Industries and an NPRE adjunct research assistant professor.

This year's recipients are NPRE students Joshua Hoffman and Amber Hunter.

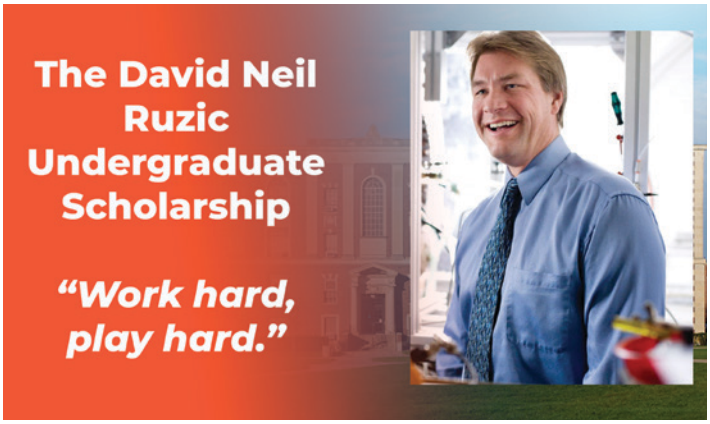
JOSHUA HOFFMAN

"Outside of research, Joshua has excelled academically, having tied in ranking at the top of his incoming class. Under the guidance of his faculty adviser, Prof. Ruzic, Joshua has laid out an accelerated academic plan to complete his BS in three years and to start his graduate study early. He plans to pursue a PhD and to continue to work in nuclear fusion research.

"Besides performing outstanding research and academics, Joshua has demonstrated service and leadership excellence. He has been heavily involved in our American Nuclear Society, serving currently on the Executive Board as Secretary and recently elected as External Vice-President for the upcoming year... Last summer he contributed to the department's pivot to on-line course delivery by assembling and operating a glass light board studio used for recording asynchronous lectures.

"As outlined above, Joshua has crammed a lot into his short two years in NPRE. He has actively demonstrated research, academic, service and leadership excellence. He well represents his NPRE program, and the plasma and fusion science and engineering area specifically. He is well deserving of receiving the inaugural David Neil Ruzic Undergraduate Scholarship within NPRE."

—Becky Meline, NPRE Senior Coordinator of Undergraduate Programs and Academic Advisor



AMBER HUNTER

"This 2nd-year student sets the bar high for those who would earn this prestigious scholarship in the future. As a Chancellor's scholar, Amber entered NPRE in the power, safety and environment concentration. Realizing the necessity and utility of electrical engineering paired with NPRE, she added the EE minor into her coursework schedule. In her first semester on campus, Amber signed on as an undergraduate research assistant with Prof. Di Fulvio's Nuclear Measurement Laboratory getting exposure to radiation detection for medical and security applications.

"At the start of her 2nd year with a full class load (some virtual, some in person), Amber accepted a co-op/internship position at Starfire Industries LLC on the University Research Park working on innovative radiation detection—specifically fast neutrons for imaging and analysis.

"This is where my experience with Amber begins. Following Prof. David Ruzic's axiom of 'Work Hard, Play Hard,' she dove right into her project setting up a research experiment station for fast neutron imaging. Amber designed and set up an R&D test station (dark box, imaging camera, software coding scripts, image processing, thermal management, optical alignment, calibration measurements, radiation shielding, check sources, neutron generator, dosimetry, etc.). Amber conducted experiments with nGen® neutron generators, performed data and image analysis, and gave presentations with our company on a new technology that will lead to a first-author publication since her contribution is at that level. Working part time 12 hours/week over a 5-month period, she outperformed—in research method, intellectual acuity, motivation, and responsiveness—pre-dissertation PhD students that I have mentored over my 20 years' experience.

"Communicative. Imaginative. Self-Starter. Resourceful. Independent. Smart. Focused. By way of these qualities, she is embracing opportunities and maximizing her undergraduate experience."

—Brian Jurczyk, President/CEO, Starfire Industries; NPRE Adjunct Research Assistant Professor

2020–2021 NPRE Awards

NPRE DEPARTMENT AWARDS, SCHOLARSHIPS, AND FELLOWSHIPS

NPRE Outstanding Academic Achievement Award for a Graduating Senior
Kip L. Kleimenhagen, Connor A. Pigg,

NPRE Outstanding Undergraduate Research Award
Andrew C. Herschberg, Erik R. Smith

NPRE Rising Undergraduate Research Award
Madeline M. Morasca, Nataly R. Panczyk

Daniel Hang Outstanding Senior Design Award
Andrew E. Christensen, Erik R. Smith, Kip L. Kleimenhagen

Roy Axford Undergrad Scholarship
Anthony C. Evans, Anthony G. Leja, Andrew H. Liu

George H. Miley LENR Undergraduate Scholarship
Andrew J. Ernat, Joshua M. Hoffman, Michael R. Hysick

David Neil Ruzic Undergraduate Scholarship
Joshua M. Hoffman, Amber H. Hunter

Catherine Pritchard Undergraduate Scholarship
Dilan T. Kurukulasuriya, James G. Shehee, Cassandra A. Soto

NPRE Visionary Scholarships
John Vincent B. Cauilan, Shmuel M. Goodman, Maria Kozlova, Braden T. Moore, Nataly R. Panczyk, Ryan M. Pierpaoli, Olivia I. Stojak

Marvin Wyman Memorial Scholarship
Armando U. Lopez, Rosendo Martinez

Felix Adler Fellowship
Aya Hegazy, Md. Akhlak Aziz, Mohammad Albati

Nguyen Thi Cuong Graduate Fellowship
Dren Qerimi

ILLINOIS AMERICAN NUCLEAR SOCIETY STUDENT CHAPTER AWARDS

ANS Undergraduate Outstanding Service Award
Anna C. Balla

ANS Graduate Outstanding Service Award
Amanda Bachmann

ANS Students' Award for Excellence in Undergraduate Teaching
Kathryn D. Huff, Tomasz Kozlowski

ANS NPRE Staff Award
Becky J. Meline

AMERICAN NUCLEAR SOCIETY NATIONAL RECOGNITIONS

Student Director
Amanda Bachmann

Alpha Nu Sigma 2021 Initiates
Sari Alkhatib, Katarzyna Borowiec, Michael Chakinis, Nicholas A. Dailey, Jasmine Dinari, Moutaz Elias, Roberto Fairhurst Agosta, Joshua Hoffman, Ibrahim Jarrah, Alvin Joon Hon Lee, Nikhil Patel, Carly Romnes, Yanqin Zhai, Taiyang Zhang

OTHER SCHOLARSHIPS AND FELLOWSHIPS

Nuclear Regulatory Commission University of Illinois at Urbana-Champaign Nuclear Engineering Fellowships)
Dominic R. Piedmont, Zoe R. Richter. Natalie C. Gaughan, Logan Crevelt, Joseph L. Bottini, Samuel G. Dotson, Lucas A. Wodrich, Oleksandr Yardas, Connor A. Pigg, Matthew A. Weiss

U.S. Department of Energy Nuclear Energy University Program NEUP Scholars
Julia K. Roessler

U.S. Department of Energy Nuclear Energy University Program NEUP Fellows
Mikayla M. Mohnar, Matthew S. Parsons

National Nuclear Security Administration Stewardship Science Graduate Fellowship
Heather N. Sandefur

NASA Space Technology Research Fellowship
Carly J. Romnes

COLLEGE OF ENGINEERING SCHOLARSHIPS

Calvin Barnes Niccolls Memorial Scholarship
Angelo J. Minetti

Engineering Visionary Scholarship
Parker A. Allen, Reese J. Peterson, Anna C. Balla, David P. Leonhardt, Rierson M. Johnson, Thomas C. Brautigam, Jordan C. Heidrick, Julia K. Roessler

Illinois Engineering Achievement Scholarship
Benjamin A. Duban, Bruno J. Caruso, Parker A. Allen, Rierson M. Johnson, Angelo J. Minetti, Anthony G. Leja, Julia K. Roessler, Justin B. Hearne, Amber H. Hunter, Shyam M. Upadhyay, Gavin A. Davis

Illinois Engineering Premier Scholarship
Connor A. Pigg

Illinois Engineering Freshman Scholarship
Armando U. Lopez, Andrew J. Ernat, Michael R. Hysick, Anthony C. Evans

Patterson Family Scholarship
Nicholas A. Dailey

William and Josephine Albrecht Engineering Scholarship
Amber H. Hunter

Edward E. & Lillian Hussemann Memorial Scholarship
Rosendo Martinez

COLLEGE OF ENGINEERING FELLOWSHIPS

SURGE Fellowship
Mikayla M. Molnar, Carly J. Romnes, Sonata M. Valaitis

Sloan University Center for Exemplary Mentoring Affiliates
Carly J. Romnes

CAMPUS RECOGNITIONS

Dean's List (Fall 2020)
David J. Atwater, John Vincent Cauilan, Bruno J. Caruso, Andrew E. Christensen, Gavin A. Davis, Nathan F. Finkelshteyn, Andrew C. Herschberg, Noah T. Isaac, Oliver W. Johnson, Kip L. Kleimenhagen, Maria Kozlova, Andrew J. Lindow, Angelo J. Minetti, Braden T. Moore, Emma G. Morano, Nataly R. Panczyk, Nikhil C. Patel, Ryan M. Pierpaoli, Connor A. Pigg, Jaime A. Robertson, Julia K. Roessler, Monica S. Savath, Erik R. Smith, Olivia I. Stojak, Shyam M. Upadhyay, Oren M. Yang, Benjamin Yoder

Dean's List (Spring 2021)
Bruno J. Caruso, John Vincent Cauilan, Andrew E. Christensen, Nicholas A. Dailey, Anthony C. Evans, Erin R. Fanning, Andrew C. Herschberg, Amber H. Hunter, Noah T. Isaac, David S. Kanfer, Kip L. Kleimenhagen, Andrew H. Liu, Angelo J. Minetti, Braden T. Moore, Emma G. Morano, Madeline M. Morasca, Nataly R. Panczyk, Aryan Panigrahi, Sean M. Peyres, Julia K. Roessler, Benjamin R. Scott, Erik R. Smith, Olivia I. Stojak, Logan J. Stralka, Shyam M. Upadhyay, Oren M. Yang, Benjamin Yoder

Chancellor's Scholars
Anna C. Balla, John Vincent Cauilan, Anthony C. Evans, Amber H. Hunter, Braden Moore

James Scholars
Parker A. Allen, Anna C. Balla, Bradly Bozzetti, John Vincent B. Cauilan, Jasmine L. Dinari, Joshua M. Hoffman, Amber H. Hunter, Oliver W. Johnson, Isaac N. Thomas, Andrew H. Liu, Braden, T. Moore, Emma Morano, Nataly R. Panczyk, Julia K. Roessler, Lisa Silverstein, Runxia Wen, Oren M. Yang

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The Engineering Visionary Scholarship Initiative attracts the brightest students, ensures a diverse and talented class, and helps reduce debt. Over 2,500 Engineering Visionary Scholarships have been awarded to Grainger Engineers since the inception of the EVS Initiative in July 2012. That support has made the difference in whether several of those students could attend the University.

We place a particular focus on highly qualified students from the state of Illinois. Your gift is the catalyst for access to education, for nurturing ambition, and for turning passions into possibilities. Your investment changes lives. For more information, go to https://grainger.illinois.edu/giving/evs.