CALENDAR

INSIDE

Welcome to the September 2023 issue of *Stewardship Science Today*. The Academic Programs of the National Nuclear Security Administration (NNSA), Defense Programs, are focused on supporting research in technical areas vital to the mission of the Stockpile Stewardship Program and on developing the talent base of young scientists and engineers with the brainpower, work ethic, and dedication to contribute to this national security mission. In this issue, we feature two of our elite fellowship programs, a successful internship program, and a prestigious academic program.

The Stewardship Science Graduate Fellowship (SSGF) and the Laboratory Residency Graduate Fellowship (LRGF) programs provide full tuition and fees, a generous stipend, an allowance for research expenses, participation in an annual program review with networking opportunities, and a 12-week research practicum at one of the national defense laboratories. The LRGF extends the benefits to a second 12-week research practicum along with opportunities for additional residencies of 6 months or more at a national defense laboratory. Please visit https://krellinst.org/ssgf or https://krellinst.org/lrgf for more information.

The NNSA's Minority Serving Institutions Internship Program (MSIIP) provides paid internship opportunities at NNSA Headquarters, national laboratories, plants, and site offices. A major objective of this program is to expose students attending minority serving institutions to the work being done at NNSA. Additionally, MSIIP provides leadership training, professional development, and networking opportunities for students, with the goal of recruiting this talent into our workforce. MSIIP does a tremendous job of exposing students to the nuclear security enterprise, bringing in 87 students during its first cohort, the class of 2022-2023, and now, 96 students in the current cohort, many of whom have applied to the NNSA Graduate Fellowship Program and extended their opportunities with their current offices.

Each of our Academic Programs hosts an annual meeting to allow for the exchange of ideas, to present current research, and to provide networking opportunities. The recent forum for the Predictive Science Academic Alliance Program is featured in this issue.

The NNSA offers a wide range of career opportunities for exceptional individuals, and the Academic Programs provide support and development opportunities. A few of the programs are featured in this issue. For more information about the NNSA Academic Programs, please visit https://nnsa-ap.us.

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Dr. Kevin C. Greenaugh
Chief Science and Technology Officer
Defense Programs

Predictive Science Academic Alliance Program (PSAAP) III Forum and PSAAP IV Pre-Proposal Meeting

PSAAP III Forum

The Predictive Science Academic Alliance Program (PSAAP) held a PSAAP III Forum in Albuquerque, New Mexico on June 6, 2023. This meeting was held in lieu of the PSAAP presentation and poster sessions normally incorporated into the Principal Investigators Meeting sponsored by the NNSA Office of Advanced Simulation and Computing & Institutional R&D Programs (ASC). The Forum provided the ASC community a singular focus where PSAAP III Centers could highlight

significant achievements over the past year, and for students and postdocs through a poster session to relay how their research advanced the Center's objectives.

Stewardship Science Graduate Fellowship and Laboratory Residency Graduate Fellowship Classes of 2023

by Krell Institute

Eleven doctoral candidates will join the Department of Energy/National Nuclear Security Administration (DOE/NNSA) Stewardship Science Graduate Fellowship (SSGF) and Laboratory Residency Graduate Fellowship (LRGF) this fall. SSGF recipients study high energy density physics, nuclear science, and properties of materials under extreme conditions. Each fellow serves a 12-week practicum at a NNSA laboratory. LRGF recipients study engineering and applied sciences, physics, materials, mathematics, and computational science. The LRGF program includes a minimum of two residencies at a NNSA laboratory, and fellows are encouraged to collaborate on their research with national laboratory personnel. Both SSGF and LRGF fellows receive tuition, a stipend, and other benefits. We welcome the 2023 Class of fellows, support their research endeavors, and encourage them to pursue a career with the NNSA national laboratories.

Stewardship Science Graduate Fellowship

At Michigan State University, **Scott Campbell** studies rare isotope mass measurements, improving on standard Penning trap spectroscopy to attain precisions of 1 to 0.01 parts per million. Many exotic isotopes are produced at rates too low or half-lives too short for reliable measurement with standard methods. With Ryan Ringle, he's implementing a phase-imaging technique that requires only about 4% of the number of ions needed for the same precision using traditional methods. Campbell also is developing a single ion Penning trap. He'll apply machine-learning models to characterize observables required for measurements.

University of Texas at Austin fellow, **Monica Martinez Henriquez**, will probe the molybdenum alloy, TZM, hoping to improve the s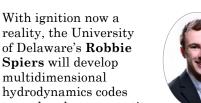trength of this and other high-temperature metals used in nuclear applications. With Eric Taleff, she'll seek ways to use stress to control subgrain size, an influential factor in material sturdiness. Martinez Henriquez will employ tensile tests of TZM and molybdenum to discern "the relationship between stress and subgrain size, measuring mechanical behavior and producing crept microstructures for microscopic characterization." Her goal is "to improve our ability to use this strengthening mechanism more efficiently."

Veera Panova of the Massachusetts Institute of Technology will research how microparticles stick in advanced manufacturing, especially cold-spray processes. The tiny pellets hit substrates at supersonic speeds, deforming and bonding to surfaces. Poor adhesion and coating defects, however, can cause failures. With Christopher Schuh, Panova will systematically use controlled single-microparticle stacking to study how surfaces evolve. She also hopes to measure temperature evolution at the interfaces during impact, another parameter that affects strength and bonding.

With ignition now a reality, the University of Delaware's **Robbie Spiers** will develop multidimensional hydrodynamics codes to explore how magnetic fields can enhance gains in inertial confinement fusion (ICF) and high energy density experiments. With Arijit Bose, he'll add magneto-hydrodynamics to an in-house radiation-hydro code to study how self-generated magnetic fields affect instability growth. He'll also research burning plasmas in both self-generated and external magnetic fields. Finally, Spiers hopes to integrate machine learning to improve predictive capability in ICF experiments.

Spectral line shape physics are critical to precisely measure astronomical and plasma properties. **Jackson White** at UT Austin is improving the theory of Stark broadened line shape profiles: spectra altered by nearby electric fields. With Don Winget, White is working to eliminate approximations that have made line shape profile calculations tractable but less accurate. One project focuses on upgrading quasi-molecular line shapes that arise when plasma particles form molecular-like structures. His technique will refine approximations to better account for penetrating particle collisions. White also investigates calculating line-shape profiles in the presence of magnetic fields.

Laboratory Residency Graduate Fellowship

At Stanford University, **Andres Castillo** develops computational models to investigate how plasma forms in a vacuum diode and expands to the anode, producing detrimental gap closure in pulsed-power devices. With advisor Kentaro Hara and in residencies with Matthew Hopkins at Sandia National Laboratories, New Mexico, Castillo will focus on magnetically-insulated transmission lines in the Z Pulsed Power Facility to discern whether plasma instabilities driven by electron flow contribute to plasma formation. He'll use Sandia and Stanford codes and compare results with experimental observations.

Raimi Clark researches a similar topic at Texas Tech University. Under Andreas Neuber, Clark studies flashover, electrical breakdown across the surface of the insulating barrier between the anode and cathode, limiting the achievable power delivered to loads on pulsed power drivers. During residencies with Adam Steiner at Sandia National Laboratories, New Mexico, Clark will perform repeated experiments at few-centimeter gap lengths on the Vulcan and Caeculus testbeds to seek empirical evidence for anode-initiated flashover. Clark will extend the capabilities of a Sandia fiber-array diagnostic to permit space- and time-resolved optical spectroscopy of flashover plasma.
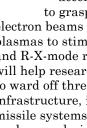
The University of Michigan's **Shailaja Humane** will use Lawrence Livermore National Laboratory (LLNL) residencies with Eugene Kur to learn and apply techniques that will help design National Ignition Facility experiments that are robust to fuel capsule defects and surface roughness. Humane and advisor Carolyn Kuranz are using lab-developed, automated design optimization code to help seek ICF platforms able to generate reproducibly high yields. They'll start with an asymmetric ovoid implosion that promises to suppress instabilities that capsule defects often seed.

Cornell University's **Josh Luoma** will use LLNL simulations and experiments to optimize MeV photon yield from microstructured laser targets for radiograph diagnostics designed for high energy density science. Microstructures, such as wire arrays, boost MeV radiation generating efficiency. When lasers strike these micron-sized arrangements, direct laser acceleration creates relativistic electron beams that collide with high-Z targets to produce radiation. Luoma, with Cornell advisor Gennady Shvets, will develop a multiscale wire array simulation. He'll use experiments during residencies with lab mentor Andreas Kemp to validate the models.

During Los Alamos National Laboratory (LANL) residencies, the Georgia Institute of Technology's **Christopher Roper** will use rocket-borne electron accelerator experiments to grasp how energetic electron beams in space couple with plasmas to stimulate whistler-mode and R-X-mode radiation. The project will help researchers develop ways to ward off threats to space-based infrastructure, including satellites and missile systems, from high-altitude nuclear explosions and natural events. With Feryal Ozel and the lab's Geoff Reeves, Roper will tap LANL's Beam Plasma Interactions Experiment (Beam-PIE) to study how energetic particle beam waves produce waves in space plasma. He'll analyze the data with computational tools, testing how simulations agree with experiments.

Dawson Wright will be the first LRGF recipient to serve residencies at the Nevada National Security Site, where he'll work with Zachary Shaw to advance designs for a compact, fast rise-time, pulsed-power source paired with a slower, high-energy Marx generator driving a nonlinear load. Dawson, who studies with Andreas Neuber at Texas Tech, says this could aid in pulse shaping or help further drive the nonlinear load's physical phenomena. "Literature has shown that coupling multiple pulsed-power sources for generators with the same output impedance is practical," Wright says in his statement. "Coupling this with the wave-shaping capabilities of modern solid-state" linear transformer drivers "would prove helpful to other areas of the NNSA complex."

Predictive Science Academic Alliance Program *(continued from page 1)*

The PSAAP III Forum included parallel breakout sessions and networking opportunities to continue enhancing collaborations between the NNSA laboratories and the U.S. academic community. The parallel breakout sessions focused on: 1) Career Opportunities at the NNSA national laboratories, at which a panel of PSAAP alumni now employed as staff members at the NNSA national laboratories described their career trajectories and answered questions from current students/postdocs at the PSAAP III Centers; and, 2) Future PSAAP Workshops, offering ideas for upcoming workshops organized around themes of common interest to multiple Centers.

PSAAP IV Pre-Proposal Meeting

ASC held a Pre-Proposal Meeting for the Predictive Science Academic Alliance Program IV (PSAAP IV) on August 8-9, 2023. This meeting was for interested U.S. PhD-granting institutions to learn about the

PSAAP IV Pre-Proposal Meeting

next phase of this NNSA academic program, which is a follow-on to the present ASC PSAAP III (see https://psaap.llnl.gov/). The primary goal of PSAAP is to establish validated, large-scale, multi-disciplinary, simulation-based "Predictive Science" as a major academic, applied research program in which predictive science refers to the application of verified and validated computational simulations to predict properties and dynamics of complex systems with quantified uncertainties.

The PSAAP IV Pre-Proposal Meeting was a great opportunity for eligible and interested attendees from U.S. PhD-granting institutions to

Minority Serving Institutions Internship Program
by Alexander Godinez-Robinson (National Nuclear Security Administration)

The Minority Serving Institutions Internship Program (MSIIP) is administered for the National Nuclear Security Administration (NNSA) by the Oak Ridge Institute for Science and Education (ORISE). MSIIP is designed to promote the education and development of the next generation of scientists and professionals to meet current and future mission needs of the NNSA by providing an enhanced training environment that exposes participants to challenges unique to the NNSA mission.

On June 5, NNSA's MSIIP welcomed 96 students to the Class of 2023-2024. This class is made up of 6 individuals pursuing Associate degrees, 67 pursuing Bachelors degrees, 13 pursuing Masters degrees, and 10 pursuing PhDs—all from different walks of life and cultures. This class draws from 50 minority serving institutions, and the interns are pursuing educational majors in such areas as law, computer science, community health, and others to support projects across the nuclear security enterprise and our national laboratories, plants, and sites.

As program participants, interns will develop the experience needed to jump-start their careers and to explore future opportunities in the federal government. Interns will be mentored by leading scientists, engineers, and other top professionals to develop their skills and enhance their leadership capabilities.

Figure 1. MSIIP Class of 2023-2024 with keynote speaker, Mr. Marcus Lea, NNSA's Deputy Associate Administrator for Management.

All interns attended a three-day orientation in Washington, D.C., where they engaged in icebreaker activities and personal crest presentations. They shared facts about themselves such as their educational history, personal hobbies, past experiences, and their goals for the internship. Interns listened to presentations from speakers who shared the roles, responsibilities, and expectations of the program and provided program briefings on the offices in the NNSA and our partners throughout the nuclear security enterprise. The orientation included professional development training sessions focused on microaggressions, active bystander, social styles, leadership principles, and effective communication and writing.

On June 8, interns returned to their host facilities and began supporting their projects in-person, virtually, and through hybrid arrangements. We look forward to seeing what the cohort will accomplish this year.

The inaugural MSIIP internship Class of 2022-2023 came to an end on June 2, as our 41 year-long interns successfully completed their appointments. Eleven of these participants returned for MSIIP's Class of 2023-2024, and three were selected for the NNSA Graduate Fellowship Program (NGFP). Two interns from the inaugural cohort, Bennett McEllis and Felicie Trebien, were selected to be featured in the ORISE success stories series. We wish our interns the best of luck in their future endeavors—continuing their education, entering the workforce, or whatever else they set their minds to!

MSIIP is already recruiting for the next class of interns with a goal of 120 interns beginning their internships in June 2024. Applications will be accepted through October 22, 2023 at 11:59 pm ET.

Internship benefits include stipends and supplements to offset the cost of housing, local transportation, and remote participation; inbound/outbound transportation reimbursement; travel and training allowances; and participation in professional development activities. Learn more about the MSIIP at https://orise.orau.gov/NNSA-MSIIP/.

Predictive Science Academic Alliance Program *(continued from page 3)*

learn about the history of PSAAP, characteristics and management of current and previous PSAAP Centers, education and lab interactions, student internships, and key cross-cutting topic areas for PSAAP IV. Those topic areas included: uncertainty quantification, scientific machine learning, extreme-scale (exascale) computing challenges, high performance computing, scientific workflow management challenges and tools, physics & engineering models, hydro algorithms, formal methods, and design optimization. A portion of the meeting focused on expectations and requirements relating to the procurement process as well as guidance for the upcoming Request for Information (RFI) and Funding Opportunity Announcement (FOA) processes. The RFI and FOA are both expected to be posted during FY 2024.

Learn more about PSAAP, view highlights from previous PSAAP-related events, view slides from the PSAAP IV Pre-Proposal Meeting, and learn more information about the current PSAAP centers at https://psaap.llnl.gov.

JUMP START YOUR FUTURE!
Application Opens August 1, 2023

MINORITY SERVING INSTITUTIONS INTERNSHIP PROGRAM

MSIIP

CLASS OF 2022-2023 INTERNS WITH NNSA ADMINISTRATOR JILL HRUBY

Are you looking for a summer or year-long internship to boost your future career opportunities? Apply to join NNSA's MSIIP Class of 2024-2025 today! MSIIP is open to all academic backgrounds. Internships begin on June 3, 2024. Application opens August 1, 2023 and are due by 11:59pm EST, October 22, 2023.

"THIS INTERNSHIP WAS AN EXPERIENCE LIKE NO OTHER. I MET PEOPLE THAT INSPIRED ME TO CONTINUE PUSHING MYSELF..." –2022 PARTICIPANT

APPLY HERE:

https://orise.orau.gov/NNSA-MSIIP/

BENEFITS:
- **Weekly Stipend - $750 Undergrad | $950 Graduate**
- **Housing, commuting, and virtual supplements**
- **Travel/training funds**

ELIGIBLITY:
- **U.S. Citizenship required.**
- **Have and maintain a minimum 3.0 on a 4.0 GPA scale.**
- **Enrollment at an accredited Minority Serving Institution.**

NNSA National Nuclear Security Administration

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