2026 SARRA Mentors and Projects Book

Service Academies and ROTC Research Associates

LANL Student Programs Office
SponsoredPrograms@lanl.gov

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Los Alamos NATIONAL LABORATORY

Project Number: 1

Project Title: “Dynamic fission heating under nuclear environment for relevant classified applications”

Mentor: Kim, S. Jun; **Co-Mentor:** Rojas, Ed

Group Name: Advanced Engineering Analysis; **Group Acronym:** E-13

Project Description: This project focuses on assessing rapid heating in nuclear environments, particularly during Reactivity Insertion Accidents (RIA) in nuclear fuel systems. It begins with a literature review, including relevant classified materials, to establish a strong theoretical foundation. Working with nuclear and thermal engineering mentors, the intern will help develop an analytic solution for heat transfer with a time-dependent heat source derived from MCNP simulations. A complementary 1D heat transfer model will be built in Python to simulate and validate thermal behavior against the analytic solution. The project provides hands-on experience in nuclear safety analysis, simulation development, and interdisciplinary collaboration.

Project Number: 2

Project Title: “Examination of Comparative Effectiveness of Simple Slab Ionospheres and Realistic Ionospheres for Modeling Radio Wave Propagation”

Mentor: Derr, Jason; **Co-Mentor:** Lay, Erin

Group Name: Electromagnetic Sciences & Cognitive Space Applications; **Group Acronym:** ISR-2

Project Description: This project will involve using a ray-tracing code to model the propagation of radio waves through the Earth's ionosphere. The ionosphere is a layer of plasma which modifies the propagation of the radio waves because the charged particles in the plasma interact with the electromagnetic fields constituting the radio wave. We have developed a code which allows the user to input a variety of altitudinal profiles for ionospheric plasma, and then witness the modification of propagating radio wave ray paths, akin to Snell's law. Often times, simple slab ionospheres are used for modeling radio wave propagation, but the Earth's ionosphere is far from that simple. There are a variety of more complicated ionosphere models ranging from empirical models like IRI to theoretical models such as the Chapman profile. These more complicated models, while more accurate, come with the cost of slowing down codes. The primary purpose of this study is to examine whether the incorporation of more complicated models provides sufficient improvement in the modeling of radio wave propagation to justify its incorporation into codes. It may involve an examination of which features of the ionosphere are most important to get correct, and which parameter regimes necessitate greater model fidelity.

Project Number: 3

Project Title: “Finite Difference Diffractive Scintillation Code for Examining Radio Wave Propagation through a Magnetized Plasma”

Mentor: Derr, Jason; **Co-Mentor:** Carlson, Brant

Group Name: Electromagnetic Sciences & Cognitive Space Applications; **Group Acronym:** ISR-2

Project Description: We have a radio frequency remote sensing program at LANL which utilizes a multiple phase screen (MPS) code that relies on model of the ionosphere, which uses the so-called parabolic equation for high frequency radio wave propagation. This model is valid at low-latitudes, but its validity diminishes at mid-latitudes and becomes invalid at high-latitudes owing to the predominantly vertical magnetic field lines. Prior work has resulted in a modified parabolic wave equation which incorporates the impact of a variety of magnetic field orientations on the index of refraction responsible for modifying the radio wave propagation. A set of finite difference equations has been written for this parabolic wave equation which has not yet been translated into code. Students involved in this project would write a finite-difference computer code to simulate the scattering of radio waves by an inhomogeneous ionosphere in the presence of background magnetic fields. The students would need to think carefully about initial conditions and background conditions, and perhaps perform error analysis that would depend on the code’s spatial grid and time steps. The aim is to examine whether anything systematic and general can be said with regard to the impact of magnetic field strength and direction on the scattering of radio waves in the presence of identical inhomogeneous backgrounds. The ideal background for those interested in pursuing this project would be some basic familiarity with differential equations and electromagnetic theory; however, a broader array of physics, electrical engineering, mathematics or other STEM backgrounds may be suitable to the project.

Project Number: 4

Project Title: “Diffractive Effects on Radio Wave Propagation in a Magnetized Plasma”

Mentor: Derr, Jason; **Co-Mentor:** Edens, Harald

Group Name: Electromagnetic Sciences & Cognitive Space Applications; **Group Acronym:** ISR-2

Project Description: This project will require using a ray-tracing code to model the propagation of radio waves through the Earth's ionosphere. The ionosphere is a layer of plasma which modifies the propagation of the radio waves because the charged particles in the plasma interact with the electromagnetic fields constituting the radio wave. Our ray tracing code allows the user to specify a background plasma and a constant magnetic field. Small scale plasma structuring transverse to the vertically stratified plasma layers causes diffraction of radio waves across a thin screen where the structuring statistics are specified. The Appleton-Hartree equation specifies the amount of ray bending (akin to Snell's law) given a particular background plasma and magnetic field configuration. The aim of this project is to determine what impact magnetic field orientation has on the scattering of radio waves propagating through the diffractive screen, while holding plasma structuring statistics constant. The student(s) will examine a variety of backgrounds and parametrize the scattering results received at a GPS satellite by plasma structure spectrum, magnetic field orientation and magnetic field strength. The ideal background for those interested in pursuing this project would be some basic familiarity with coding and electromagnetic theory; however, a broader array of physics, electrical engineering, mathematics or other STEM backgrounds may be suitable to the project.

Project Number: 5

Project Title: "What does lightning look like from GEO? Harnessing the unique perspective of RFS."

Mentor: Biermann, Emily; **Co-Mentor:** Wolfenbarger, Natalie

Group Name: Electromagnetic Sciences & Cognitive Space Applications; **Group Acronym:** ISR-2

Project Description: The Radio Frequency Sensor (RFS), launched in December 2022, is the first instrument to collect VHF lightning data from geosynchronous orbit. From this unique vantage point, RFS has enabled scientists to study the evolution of radio frequency (RF) lightning signatures in thunderstorms from a new perspective. Students will have the opportunity to analyze data collected by RFS and other complementary sensors to study lightning processes and thunderstorm evolution. The skills developed during this project (e.g., Python, machine learning, signal processing) will provide the student with experience in space-based remote sensing of radio frequency signals which have broader applications beyond lightning science.

Project Number: 6

Project Title: "Los Alamos Portable Pulser system development and performance"

Mentor: Edens, Harald; **Co-Mentor:** Dreesen, Wendi

Group Name: Electromagnetic Sciences & Cognitive Space Applications; **Group Acronym:** ISR-2

Project Description: The Los Alamos Portable Pulser (LAPP) serves an important role in the lab's nuclear nonproliferation mission. The system consists of a 13 meter parabolic antenna with 1 MV Marx generator mounted to a feed structure at the prime focus. The pulsed transmitter can be used to study radio wave propagation through the ionosphere by firing RF pulses to on-orbit receivers such as LANL's RFS sensor on StpSat6. The students will work closely with the LAPP team in projects involving system performance and reliability, Marx bank diagnosis, software development in Python, and supporting operations, depending on the background of the student. Students interested in participating in this project ideally have a basic familiarity with RF transmitters and antennas, and a STEM background.

Project Number: 7

Project Title: "Environmental Contaminant Data Analysis and Visualization using Python"

Mentor: Moss, Philip (Michael); **Co-Mentor:** Gould, Sarah

Group Name: Environmental Stewardship; **Group Acronym:** EPC-ES

Project Description: The students would look at environmental data that is publicly available and sampled by N3B, a government contractor. The idea of the project is for the students to develop data analysis and visualization skills in Python and Excel while at the same time bringing awareness to LANL stakeholders, such as Compliance Programs, regarding a environmental contaminant of concern. The environmental contaminants would be chosen based on student interest and mentorship guidance. Due to the short nature of the assignment for the students, previous experience with Python would be helpful and/or at least a strong interest in learning how to use Python. The deliverable would be a poster presentation giving background regarding the contaminant and showing the data visualizations the student utilized to illustrate the contamination levels.

Project Number: 8

Project Title: "PLEIADES Code Development"

Mentor: Long, Alexander; **Co-Mentor:** Vogel, Sven

Group Name: Materials Science In Radiation & Dynamics Extremes; **Group Acronym:** MST-8

Project Description: The PLEIADES project integrates nuclear resonance evaluation tools such as SAMMY into a modular, modern software framework. SAMMY is a legacy code that processes resonance parameters and experimental data using complex input files and applies Bayesian methods to fit theoretical nuclear cross sections to experimental results.

The PLEIADES project focuses on improving robustness and usability of SAMMY by creating Pythonic models using Pydantic, building a full suite of pytest-based unit tests, and modernizing user interfaces. The student will design models for SAMMY configuration and execution, validate them against the formal specifications in the SAMMY documentation, and write tests to ensure correctness across multiple SAMMY modalities of data analysis.

Project Number: 9

Project Title: "Classified Library Support Staff"

Mentor: Templeton, Patty; **Co-Mentor:** Piccolo, Angie

Group Name: National Security Research Center Mission Support; **Group Acronym:** WRS-NSRCMS

Project Description: Help support the nation's nuclear deterrent by assisting the National Security Research Center, LANL's classified library, in cataloging and preserving unique materials from underground and atmospheric testing eras. Possible projects include inventorying physical collections, digitization initiatives, assisting in classified controlled vocab development to support AI initiatives, and classified digital asset management. (No previous archival or library experience required.)

Project Number: 10

Project Title: "Nuclear Forensics"

Mentor: Lloyd, Cody; **Co-Mentor:** Keith, Corey

Group Name: Nuclear & Radiochemistry; **Group Acronym:** C-NR

Project Description: The student will work on the Debris Diagnostic team in the Nuclear and Radiochemistry Group and help support the operational post-detonation nuclear forensic program. Using archival radiochemistry data from debris samples, the student will model and evaluate the performance on historic nuclear events. The project will involve learning about the radiochemical signatures and post-detonation processes, from debris collection through device assessment.

Project Number: 11

Project Title: "Data Visualization & Storytelling for NSE Decision-Makers"

Mentor: Gerts, Dax; **Co-Mentor:** Dale, Crystal

Group Name: Nuclear Systems; **Group Acronym:** NEN-5

Project Description: Regardless of domain, the task of rendering dense, technical information down to only the most salient details and making it presentable to high-level decision makers remains challenging and essential. This is especially true when guiding decisions around the planning of the nation's nuclear weapons stockpile, where minute details of a decision may have secondary and tertiary effects measured over decades and across many organizations. Through this internship, students will become familiar with the analytic techniques used for decision support in the nation's Nuclear Security Enterprise (NSE) and have opportunities to design, build, and test new methods of presenting analytic results for high-level decision makers. Some experience in programming and/or data visualization is preferred.

Project Number: 12

Project Title: "Integrated Weapon Experiment Workflow Analysis"

Mentor: King, Gabriel; **Co-Mentor:** Cartas, Andrew

Group Name: Nuclear Systems; **Group Acronym:** NEN-5

Project Description: The Integrated Weapon Experiment (IWE) program at LANL is part of our continuous effort to validate nuclear weapon safety, security, and effectiveness. IWE's require the collective effort of over a dozen large and/or highly specialized organizations at LANL. In an effort to increase the efficiency of the IWE program, our team is engaged in multiple efforts to analyze the IWE workflow to identify opportunities for improvement. Through this internship, students will get a broad overview of the Weapons program at LANL, management strategies for interconnected workflows, and modeling in a collection-constrained environment. The work will primarily consist of Excel analysis and visualization, but there is an extra opportunity for those who wish to become familiar with Stella Architect.

Project Number: 13

Project Title: "Nuclear Weapons Stockpile Modeling"

Mentor: Baxter, Stephen; **Co-Mentor:** Newton, Destry

Group Name: Nuclear Systems; **Group Acronym:** NEN-5

Project Description: The Nuclear Security Enterprise is responsible for building and sustaining the nation's stockpile of nuclear weapons. This is a highly complex endeavor, the logistics of which can be modeled to inform leaders about the impacts and viability of various options. Through this internship, students will become familiar with the Nuclear Security Enterprise, the fundamentals of nuclear weapon design and production, and the various legacy and future nuclear weapons in the US stockpile. Experience with programming preferred, but not required.

Project Number: 14

Project Title: "Using Large Language Models to Assess Vaccine Platform Technologies"

Mentor: Hlavacek, Bill; **Co-Mentor:** McMahon, Ben

Group Name: Theoretical Biology and Biophysics; **Group Acronym:** T-6

Project Description: This project investigates the use of large language models (LLMs) to systematically extract and synthesize information from the scientific literature on vaccine development. The student will design and implement multi-step LLM workflows capable of identifying and comparing the strengths, limitations, and applicability of various vaccine platform technologies—such as mRNA, viral vectors, and subunit approaches—for specific pathogens of concern. The workflows will integrate automated document retrieval, domain-specific information extraction, and structured summarization to support evidence-based evaluations of vaccine platforms. This work will contribute to a broader effort to inform platform selection for emerging biological threats.

Project Number: 15

Project Title: "Tensor Train Uncertainty Quantification for Ballistic Trajectories"

Mentor: Andrews, Stephen; **Co-Mentor:** Hass, Ryan

Group Name: Verification qnd Analysis; **Group Acronym:** XCP-8

Project Description: Variations in the initial conditions and aerodynamic performance in unguided munitions can result in uncertainty in the trajectory of air launched weapons. This study seeks to use a Tensor Train Uncertainty Quantification framework to asses the uncertainty in the impact point due to a range of relevant uncertainty parameters. The ideal candidate would be a cadet from the Naval Academy who is aiming to become a Naval Aviator.

Project Number: 16

Project Title: “Engineering Support to Weapons Production”

Mentor: Gerving, Corey; **Co-Mentor:** Davidson, Justine

Group Name: W88 Systems Engineering; **Group Acronym:** W-4

Project Description: W-Division is actively involved in the current operations of sustaining and maintaining the nation's nuclear deterrent. Prospective students will participate in active investigations of stockpile anomalies and in the development of solutions for immediate implementation into the weapons design and fabrication operations.

Project Number: 17

Project Title: “Nuclear Weapons Effects Analysis”

Mentor: Goorley, Tim; **Co-Mentor:** Harwell, Megan

Group Name: Weapons Design; **Group Acronym:** XTD-DO

Project Description: Nuclear Weapons Effects spans a wide variety of disciplines and specific projects will be formed relating to the student's skills and interests. Examples of recent student projects include understanding effects on satellites from space detonations, estimating modern submarine kill from underwater detonations based on WWII nuclear tests, generating a tool to evaluate different nuclear strike scenarios. While STEM majors are preferred, History and Political Science students would also find interesting work in the weapons effects field.

Project Number: 18

Project Title: “W93 Flight Test Program”

Mentor: Rhodes, Austin; **Co-Mentor:** Hogan, Tobias

Group Name: Weapons Test Execution; **Group Acronym:** V-21

Project Description: As a Q-cleared intern assigned to the W93 flight test program, you will be assisting with various aspects of planning, assembling, and testing a representative test article in support of W93 program objectives. Previous SARRA interns have designed and conducted rapid prototyping and characterization tests of various test subjects and will be eligible to continue a capstone project in their senior academic year. A STEM major is required; an engineering major is preferred, as most of the work will be building on STEM concepts related to test engineering.
