

ALEXANDRA AKINS

853 Cross Link Rd, Raleigh, NC 27610
Phone: (727) 282-9991, Email: agakins@ncsu.edu



RESEARCH INTERESTS

- Scientific machine learning
- Uncertainty Quantification
- Advanced reactor thermal hydraulics
- Anomaly detection
- Deep generative learning

EDUCATION

Ph.D. in Nuclear Engineering North Carolina State University, Raleigh, NC, USA Overall GPA: 3.8/4.0	expected May 2027
M.S. in Nuclear Engineering North Carolina State University, Raleigh, NC, USA Overall GPA: 3.8/4.0	May 2025
B.S. in Nuclear Engineering North Carolina State University, Raleigh, NC, USA Overall GPA: 3.7/4.0	May 2023
B.A. in International Studies <i>Concentration in sustainable development</i> North Carolina State University, Raleigh, NC, USA Overall GPA: 3.7/4.0	May 2023

RESEARCH AND WORK EXPERIENCE

Research Aide <i>Argonne National Laboratory</i>	2022 - present <i>Lemont, IL</i>
<ul style="list-style-type: none">• Conceptualized and applied for a patent based on autonomous molten salt concentration monitoring.• Developed machine learning-based anomaly detection models in Advanced Reactor designs.• Adapted multiple TensorFlow artificial neural network designs to real problems concerning liquid sodium thermal hydraulic and electrochemical data.• Conducted research for a project since 2023 that is a collaboration between Oklo and Argonne for autonomous concentration detection in electrochemical measurements of molten salt.• Integrated machine learning based uncertainty quantification method Monte Carlo Dropout in ML models for prediction on sodium thermal hydraulic data.	

Undergraduate Researcher
North Carolina State University

2020-2023
Raleigh, NC

- Applied physics informed neural networks (PINNs) to model the Point Reactor Kinetics Equations system of four nonlinear tightly coupled ordinary differential equations that described a reactivity insertion accident in a nuclear reactor.
- Managed a weekly meeting schedule for undergrads to teach foundational scientific machine learning.
- Participated in Women and Minorities Summer Research Experience in Summer 2021.

Science Undergraduate Laboratory Internships (SULI)
Argonne National Laboratory

Summer 2022
Lemont, IL

- Compared applications of LSTM Autoencoders, variational autoencoders, and principal component analysis for use in anomaly detection within Sodium-cooled Fast Reactors.
- Selected to be one of four young researchers who met and spoke with the Secretary of Energy, Jennifer Granholm, representing the future of nuclear engineering research.
- Interviewed for the Argonne All-Hands meeting, alongside such figures as Paul Kerns, the director of Argonne.

PEER-REVIEWED JOURNAL ARTICLES

1. Alsafadi F., **Akins A.**, & Wu X. (2026). Towards Overcoming Data Scarcity in Nuclear Energy: A Study on Critical Heat Flux with Physics-consistent Conditional Diffusion Model. *in revision at Energy and AI*
2. **Akins, A.**, Kultgen, D., Wu, X., & Heifetz, A. (2025). Monte Carlo Dropout Uncertainty Quantification of Long Short-Term Memory Autoencoder Anomaly Detection in a Liquid Sodium Cold Trap. *Nuclear Technology*, 1-14.
3. **Akins, A.**, Furlong, A., Kohler, L., Clifford, J., Brady, C., Alsafadi, F., & Wu, X. (2024). ARTISANS—Artificial Intelligence for Simulation of Advanced Nuclear Systems for Nuclear Fission Technology. *Nuclear Engineering and Design*, 423, 113170.
4. **Akins, A.**, Kultgen, D., & Heifetz, A. (2023). Anomaly Detection in Liquid Sodium Cold Trap Operation with Multisensory Data Fusion Using Long Short-Term Memory Autoencoder. *Energies*, 16(13), 4965. (*selected as a Featured Article by the Editor*)

PEER-REVIEWED CONFERENCE PAPERS AND SUMMARIES

1. **Akins, A** & Wu, X. (2026). Physics-Informed Diffusion Model for Generation of Physically Consistent Critical Heat Flux Data. In Transactions of American Nuclear Society. Denver, CO, USA, May. 32- Jun 3, 2026. (Submitted)
2. **Akins, A.**, Kultgen, D., Wu, X., & Heifetz, A. (2025). Enhanced Anomaly Detection in Liquid Sodium Cold Trap Operation with Synchronization of Time Series of Multi-Modal Sensors. In Proceedings of the 21st International Topical Meeting on Nuclear Reactor Thermal Hydraulics (NURETH). Busan, Korea, Aug. 31-Sep. 5, 2025.

3. **Akins, A.**, Polke, A., DelaCruz, S., Hoyt, N., & Heifetz, A. (2024). Machine Learning-Assisted Chemometrics for Concentration Detection from Linear Sweep Voltammetry Measurements. In Transactions of American Nuclear Society. Orlando, FL, USA, Nov. 17-21, 2024.
4. **Akins, A.**, Wu, X, Kultgen, D., & Heifetz, A. (2024). Monte Carlo Dropout Uncertainty Quantification of Long Short-Term Memory Autoencoder Anomaly Detection in a Liquid Sodium Cold Trap. In Proceedings of the Best Estimate Plus Uncertainty (BEPU) Conference 2024. Lucca, Italy, May 19–23, 2024.
5. **Akins, A.**, Kultgen, D., & Heifetz, A. (2023). Anomaly Detection in a Cold Trap Liquid Sodium Purification System through Multisensory Data Fusion with Deep Learning Autoencoders. ANS Student Conference, Knoxville, TN, USA, Apr. 13-15, 2023.
6. **Akins, A.**, Griffin, T., Osborne, H., Trucks, C., Palmer, J., Yang, G., Design and Testing of Low Pressure Heated Subcapsule for Use in Irradiation Experiments. Knoxville, TN, USA, Apr. 13-15, 2023.
7. **Akins, A.**, Kultgen, D., & Heifetz, A. (2022). Utilizing Long Short Term Memory Networks in an Autoencoder for Anomaly Detection for Thermal Mixing in a Water Loop. In Transactions of American Nuclear Society. Phoenix, AZ, USA, Nov. 13-17, 2022.
8. **Akins, A.** & Wu, X. (2022). Using Physics-Informed Neural Networks to solve a System of Coupled ODEs for a Reactivity Insertion Accident. In Proceedings of the International Conference on Physics of Reactors 2022. Pittsburgh, PA, USA, May 15–20, 2022.
9. **Akins, A.**, Xie, Z., & Wu, X. (2021). Solving a System of Ordinary Differential Equations for Reactivity Insertion Accident with Artificial Neural Networks. In Transactions of American Nuclear Society. Washington, DC, USA, Nov. 30 - Dec. 4, 2021.

HONORS AND AWARDS

- National Science Foundation (NSF) Graduate Research Fellowship 2023
- Selected as a Rising Star by the OECD Nuclear Energy Agency (NEA) Global Forum on Nuclear Education, Science, Technology and Policy 2023
- ANL Impact Award 2023
- NCSU Sustainability Award 2023
- NCSU Nuclear Engineering Best Senior Design Presentation 2023
- American Nuclear Society Student Conference Best Undergraduate Paper 2023
- U.S. DOE Nuclear University Leadership Program Scholarship 2021, 2022
- U.S. NRC Nuclear Education Program Scholarship 2020
- D. Rex Smith/Benjamin Franklin Dual Degree Scholarship 2020, 2021, 2022

RELEVANT COURSEWORK

- **Nuclear Engineering**
Reactor Analysis and Design, Reactor Engineering, Reactor Heat Transfer, Radiation Safety and Shielding, Reactor Systems, Scientific Machine Learning, Monte

Carlo Methods and Applications, Nuclear Nonproliferation, Nuclear Materials, Nuclear Criticality and Safety, Nuclear Fuel Cycles

- **Mathematics**

Uncertainty Quantification, Calculus I, Calculus II, Calculus III, Applied Differential Equations I, Applied Differential Equations II

- **Statistics**

Fundamentals of Inference I, Fundamentals of Inference II

TECHNICAL SKILLS

- Python, MATLAB, R, L^AT_EX
- Tensorflow, PyTorch, Pandas, scikit-learn
- MCNP

LEADERSHIP AND EXTRACURRICULAR

Presentations

- American Nuclear Society Annual Conference and Expo 2026
- American Nuclear Society Winter Conference and Expo, multiple years
 - 2024, 2023, 2022, 2021
- International Conference on Physics of Reactors (PHYSOR 2022)
- Advances in Nuclear Nonproliferation Technology and Policy Conference (ANTPC 2023)
- Best-Estimate Plus Uncertainty (BEPU 2024)
- 21st International Topical Meeting on Nuclear Reactor Thermal Hydraulics (NURETH 21)
- NCSU 2025 Applied AI in Engineering & Computer Science Symposium

Technical Meeting

International Atomic Energy Agency

2024

Vienna, Austria

- Capitalizing on artificial intelligence analysis to accelerate the technological development of evolutionary and innovative reactor designs.
- Presented virtually on work related to uncertainty quantification of automated anomaly detection for a liquid sodium purification system.

Global Forum Rising Stars Workshop

Nuclear Energy Association

2023

Cambridge, MA

- International workshop hosted by the NEA and Massachusetts Institute of Technology.
- Encouraged female rising stars in science, technology, education and policy into positions within the global nuclear community.
- Presented summary of work conducted with Argonne National Laboratory to an audience which included NEA Director-General William D. Magwood, IV.

American Nuclear Society

2020-ongoing

- Member of ANS since 2020
- Presented at 6 ANS Annual and Winter Meetings.
- Received the 2023 ANS student conference Best Undergraduate Paper.

Volunteer
Raleigh City Farm

2023-ongoing
Raleigh, NC

- A local non-profit organization that provides pay-what-you-can fresh produce to low income communities through sustainable agriculture.

Student Coordinator for the Sustainability Stewards
Office of Sustainability at North Carolina State University

2019-2023
Raleigh, NC

- Led a group of 30 students in efforts across campus to make the university and our peers more sustainable.
- Successfully achieved funding for two major projects.
- 32,000 dollars were raised for SolarSpace, a solar powered structure outside of Burlington Lab where students can charge their personal devices and collaborate in an outdoor space.
- 26,000 dollars were raised for Campus Green Spaces, a project that was completed in May 2023, which entails a series of gardens where students can interact with pollinator friendly plants and aromatic herbs to encourage mental health.
- Curated a campus-wide competition to encourage students to conserve energy and water that reached all students living in dorms, a total of over 8,900 students.