

# Nuclear Engineering Seminar

## Dr. Yang Liu

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**3:30pm | PHYS 112**

Advancing nuclear thermal-hydraulic modeling in the age of data

### Abstract

Significant progresses have been made in nuclear thermal-hydraulic (T-H) research in the past decade on high-resolution experimentation and high-fidelity simulation, enabling the generation of rich data more than ever before. However, these rich data are not fully utilized as gaps still exist between experimentation, high-fidelity simulation, and nuclear system modeling.

In this talk, a systematic approach based on machine learning (ML) and data-driven methods will be presented that can leverage multi-scale, multi-fidelity data from heterogeneous sources to improve the predictive capability of nuclear T-H model. Specifically, this talk will involve two topics: (1) Uncertainty Quantification (UQ) and (2) data-driven modeling. In the first topic, a UQ framework will be discussed that can effectively reduce and quantify T-H model uncertainty. In the second topic, a novel approach that integrates ML model as data-driven closure with nuclear system code will be discussed, with a demonstration of the newly developed ML enhanced SAM (System Analysis Module) capability.

The developed products can facilitate the development and deployment of advanced reactors by reducing the licensing burden through comprehensive UQ; and by improving economics through accurate safety margin predictions.



Dr. Yang Liu is a Nuclear Engineer at Argonne National Laboratory. He obtained his Ph.D. degree in Nuclear Engineering at North Carolina State University. Prior to joining Argonne, he was a postdoc at the University of Michigan. His research interests mainly focus on physics-informed machine learning and its applications in nuclear thermal-hydraulic modeling.