MASTER SUMMER TRAINING PROPOSAL

Academic Year 2025/2026

TITLE: Development of surrogate models for expensive calculations.

ADVISOR: Pablo Giuliani and Kyle Godbey
ADVISOR CONTACT- giulianp@frib.msu.edu and godbey@frib.msu.edu
Co-ADVISOR: J. Margueron from IRL-NPA
Co-ADVISOR CONTACT- email: jerome.margueron@cnrs.fr

UNIVERSITY/RESEARCH CENTER of the TRAINING:
Michigan State University; Facility for Rare Isotope Beams (FRIB);
International Research Laboratory NPA.

LEVEL
Expected level of student: Master.

DURATION
Max 4 months, including max 3 months at FRIB.

TOPIC
Machine learning, emulators, computation, theoretical modeling.

ABSTRACT

The incoming student will work on using dimensionality reduction techniques to develop surrogate models for expensive numerical calculations (see https://www.frontiersin.org/articles/10.3389/fphy.2022.1054524/full, and https://journals.aps.org/prc/abstract/10.1103/PhysRevC.109.044612). The approach will follow a series of recent data-driven approaches (see https://arxiv.org/abs/2502.03680, https://arxiv.org/abs/2406.04279, and https://youtu.be/XiRFiH-7MG8?si=rcyS-sU4eZVEgjWa&t=1321). If the student comes with a specific model/simulation in mind the project will focus on creating an emulator for that, but other options are available ranging from reactions, nuclear structure calculations, nuclear astrophysics, and experimental control. We expect that after the end of the program the student will be able to bring to their home institution the knowledge to apply dimensionality reduction techniques to speed up computations and tailor them to their specific needs. If progress during the three month period was effective, we also expect to write a publication with the findings.

Expected incoming student skills: Intermediate coding experience in at least one language (python, Mathematica, c++, fortran). Basic knowledge of differential equations.

Please note that this spring-summer training does not imply a continuation for a PhD.

More information is available on the website https://npa.in2p3.fr/summer-training-program/