Fermi National Accelerator Laboratory
LDRD Project Data Sheet - FY21

Project ID: FNAL-LDRD-2021-004

Project title: Developing simulation-based Inference to enable next-generation cosmological discoveries

Principal investigators: Brian Nord, Yuanyuan Zhang

Project description: (short description and explanation of cutting edge, high-risk, high-potential science or engineering)

In this project, we will develop and test a software package that facilitates the use of Simulation-Based Inference (SBI) in cosmological parameter estimations. We aim to facilitate the adoption of SBI methods across the cosmology community by connecting existing SBI packages to CosmoSIS, a software platform that is widely used in the cosmology community. The plan for this research project contains the three following elements: compare existing SBI software packages, integrate the SBI software package with CosmoSIS, and scientifically validate the SBI package with a galaxy cluster cosmology analysis. This will include development of deep learning models to be used within the SBI framework.

Tie to Mission: (explain the project's relevance or anticipated benefits to Fermilab's and DOE's missions)

This project will enhance Fermilab's leadership in scientific computing, and in particular, applying machine learning methods in scientific analysis. Through this effort, it will also improve the scientific output of DOE supported dark energy cosmic experiments by bringing new methods into their key scientific goals.

Previous year's accomplishments: (as applicable) N/A

Work proposed for current fiscal year and anticipated / desired results:

Familiarize with existing SBI packages, and outline project requirements for connecting with CosmoSIS, penultimate step in deep learning model development, begin recruitment of Post-Doctoral Research Associate.

Project funding profile: (costs, budgets, projected budgets, and total)

Prior year(s) costs	FY21 ½	FY22	FY23	FY24 ½	Total
N/A	$73,723	$300,000	$300,000	$225,000	$898,723

Project Start Data: 3/1/2021 Total Approved Project funds: $898,723