Proposal Summary

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The NOvA long-baseline accelerator neutrino experiment, the current flagship experiment in operation at Fermilab, is projected to continue to run until 2024. Taking into consideration Fermilab's current plans to improve the NuMI beam intensity, NOvA has an opportunity to measure $\mu - \tau$ symmetry up to 5σ, the octant of θ_{23} up to 3σ, the neutrino mass hierarchy up to 4σ, and measure CP violation up to 3σ. To help enable and achieve the milestones in this rich physics program, I am leading the ongoing NOvA Test Beam effort, which will use a scaled-down version of the NOvA detectors exposed to particle beams of known momenta at the Fermilab Test Beam facility using a new MCenter-sourced tertiary beam line. As an Intensity Frontier Fellow I will be able to have a continued presence at Fermilab during the most critical phase of the effort, when I will be coordinating and contributing to the deployment, installation, and commissioning of detector and beamline between May and December 2018, as well as to operations during a 6-month run between December 2018 and June 2019. The data analysis work I plan to launch during this period has strong potential to significantly reduce systematics uncertainties in the NOvA analyses, and improve modeling of the detector response, along with providing a precise cross-check of the NOvA detector calibration.

The measurement capabilities of HEP detectors have grown tremendously over the past few years in terms of both production of vast amounts of data and large increases in resolution and precision. Understanding how well data matches theory is critical for extending physics reach, and this growth is presenting important computing challenges to the HEP community, compounded by the increasing complexity of fits to data to extract increasingly precise physics measurements. As an Intensity Frontier Fellow, I will be addressing these challenges by contributing to a new effort, supported by a recently awarded multi-institution DOE SciDAC-4 grant, to develop tools for carrying out NOvA's analyses in High-Performance Computing environments, which could shorten the production of new NOvA results very significantly. This work will also entail the development of high-performance computing tools to expedite event reconstruction in LAr, which could greatly benefit DUNE and potentially the SBN program at Fermilab.