Project Proposal Summary

Kazuhiro Terao

In this application, I propose an Intensity Frontier Fellowship to support my work on Deep Learning techniques in event reconstruction and physics analysis for MicroBooNE. Deep Learning is a technique that uses state-of-the-art machine learning algorithms associated with the field of artificial intelligence. In particular, the techniques will be used to probe, using MicroBooNE data, the unexpected ν_e excess at low visible energy observed by the MiniBooNE collaboration. Under my leadership, we have recently published a paper where we showed promising results for the use of deep learning in the reconstruction and physics analysis of LArTPC data. This proposed fellowship will support work on the next step, which is to implement this technique for a full physics analysis chain for MicroBooNE.

After leading the above publication effort, I formed and currently convene the deep learning analysis group in the collaboration. The group has a strong contingent of students, postdocs, and physicists along with access to high-performance computing resources and is making a rapid progress to overcome the challenges noted in the Research Statement. My presence at Fermilab supported by this fellowship is crucial to be able to lead this effort, which combines contributions from remote institutions as well as interactions with other analysis group conveners on MicroBooNE. A successful completion of this project will lead to the first MicroBooNE results on the nature and possible excess of ν_e events at low energy. These developed generic reconstruction tools using deep learning also hold the promise for improving the analysis of future LArTPC experiments including the SBN and DUNE programs.