

CSU PHYSICS COLLOQUIUM

“Unlocking Precision Physics at LArTPC Neutrino Experiments ”

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120 Engineering (Hammond Auditorium)

Abstract

The Deep Underground Neutrino Experiment (DUNE) at the Long-Baseline Neutrino Facility is an international project that will be the largest particle physics experiment ever built in North America. The DUNE project will use massive liquid argon time projection chambers (LArTPCs) to address fundamental questions such as the origin of the matter/antimatter asymmetry in the universe. In order to answer such questions, DUNE will make measurements that probe the nature of neutrino oscillation, the changing of neutrino flavor (electron, muon, or tau) during the flight from source to detector, with unprecedented precision. Another upcoming neutrino oscillation experiment is the Short-Baseline Neutrino (SBN) Program, which will use multiple LArTPC detectors to investigate the anomalous phenomenon of neutrino oscillation over shorter distances that could lead to the discovery of "sterile" neutrinos. Both DUNE and the SBN Program rely on precise measurements of neutrino-argon interactions, necessitating an extensive calibration program for the LArTPC detectors recording these interactions. In this talk, a multi-experiment LArTPC detector calibration program is presented, building off of initial work at MicroBooNE (a predecessor experiment to the SBN Program) and culminating in a full calibration plan for the SBN Program and DUNE. The physics measurements enabled by this calibration plan are discussed, including first results on investigations of previous neutrino anomalies at MicroBooNE.

Biography

Prof. Mike Mooney is an Assistant Professor in the CSU Physics Department, where he is a part of the High-Energy Physics and Particle Astrophysics (HEPPA) group. He received his PhD from Princeton University in 2014 for work on the CMS experiment at the Large Hadron Collider (LHC), where he worked on a search for the Higgs boson decaying to bottom quarks. As a postdoc at Brookhaven National Laboratory (BNL), he began working on several LArTPC neutrino experiments, including MicroBooNE, the SBN Program, and DUNE. His continued research at CSU on these experiments has culminated in a DOE Early Career Research Program award in 2020. Prof. Mooney served as MicroBooNE's Run Coordinator during the experiment's first operations and currently serves as the co-convenor of several different calibration-related working groups on the SBN Program and DUNE. Additionally, he serves as the L3 manager for TPC Module Assembly and Testing for DUNE's LArTPC near detector.