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Argon Ionization Laser Calibration System for DUNE and Neutral and Charged Current Neutrino Cross Sections for Liquid Argon Detectors

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The Deep Underground Neutrino Experiment (DUNE) is the next generation long-baseline neutrino experiment. DUNE's far detector modules are based on liquid argon time projection chamber (LArTPC) technology and will be the largest LArTPCs ever to be built. In this talk, I will present two topics related to DUNE that I am currently working on. The first topic is the development of an ionization laser calibration system for DUNE. This system consists of a class IV laser with steerable mirrors mounted on LAr-immersed optical periscopes to provide a well-defined source of ionization laser tracks for calibrating the DUNE detector. The primary purpose of the IoLaser system is to provide independent fine-grained measurements of detector response parameters as well as to serve as a diagnostic tool. I will introduce the IoLaser system, present the current status and discuss future plans. The second topic is related to supernovae detection in DUNE. I will present the neutrino neutral current cross sections on ^{40}Ar at neutrino energies expected for supernova events. I will also examine the charged current cross sections using the large shell model calculations that are constrained by $B(\text{GT})$ and $B(\text{F})$ measurements but include operators to all orders in q^2 .

Primary author: NEWMARK, Darcy (Los Alamos National Laboratory)

Presenter: NEWMARK, Darcy (Los Alamos National Laboratory)

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