Canadian Association of Physicists
Association canadienne des physiciens et physiciennes

Contribution ID: **193** Type: **Invited Speaker / Conférencier(ère) invité(e)**

# Exploring the Nature of Neutrinos with the Deep Underground Neutrino Experiment (DUNE)

*Tuesday 10 June 2025 10:15 (30 minutes)*

The Deep Underground Neutrino Experiment (DUNE) is a next-generation experimental program designed to study the behaviour of neutrino oscillation. DUNE will utilize a neutrino beam originating at Fermilab, near Chicago, and will leverage a detector at Fermilab (Near Detector) and a detector 1300 km away in South Dakota (Far Detector), south of Saskatchewan.

In the first phase of DUNE, its Far Detector will comprise of two 10,000 ton (fiducial) liquid argon (LAr) time-projection chamber (TPC) modules –powerful tracking calorimeter detectors –placed nearly a mile underground. With this large, sensitive, underground detector, DUNE aims to collect a high statistics and pure sample of neutrinos at the Far Detector. This setup also offers the potential to study non-beam physical processes via e.g. neutrinos produced in the atmosphere, supernova neutrino bursts, and/or solar neutrinos, etc. A second phase will aim to add more detector mass and expand the program.

The Near Detector will consist of a LAr TPC module as well: critical to constraining systematic uncertainties in the oscillation analysis. However, this LAr TPC will have a novel design using a pixel-based readout instead of the traditional wire-based readout. This and the segmentation of the LAr TPC into multiple units are crucial in mitigating the high multiplicity of neutrino interactions expected in any readout window given its proximity to the beam. The Near Detector will feature additional components and capability beyond the LAr TPC, allowing one to deeply characterize the neutrino flux.

Due to the complexity of this experimental program, several smaller-scale prototype detectors have been operating to test, validate, and improve both the technical designs and software for processing and analyzing events. By operating in charged particle test beams or neutrino beams, several of the prototypes are also capable of producing valuable results.

Canadian institutions are involved in the realization of the DUNE through efforts with both the Near and Far Detectors and prototypes. DUNE is anticipated to begin operating near the end of this decade/the beginning of the next. This talk will focus on the overall DUNE program, for example its ultimate plans, status, and the efforts with prototypes.

## Keyword-1

Neutrinos

## Keyword-2

Neutrino oscillation

## Keyword-3

DUNE

**Author:** HOWARD, Bruce (York University & Fermilab)

**Presenter:** HOWARD, Bruce (York University & Fermilab)

**Session Classification:** (PPD) T1-9 Neutrino experiments | Expériences de neutrinos (PPD)

**Track Classification:** Technical Sessions / Sessions techniques: Particle Physics / Physique des particules (PPD)