Department of Physics
Particle Physics
The Denys Wilkinson Building, Keble Road, Oxford OX1 3RH

UNIVERSITY OF OXFORD

Experimental Particle Physics Seminar

at 2.15 pm
Dennis Sciama Lecture Theatre

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Large dual phase liquid argon TPC development and operation at CERN

Abstract

Giant Liquid argon TPCs (LAr-TPCs) represent unique setups to detect and study neutrinos and other rare phenomena such as proton decay and have been under development for many decades. The technology provides a dense target with unprecedented 3D imaging capabilities and a homogeneous full sampling calorimeter that can be operated over a wide range of energies. The Deep Underground Neutrino Experiment (DUNE) envisages to deploy up to four 10 kt LAr TPC modules in a mine in South Dakota (USA). The DUNE underground neutrino observatory coupled to a powerful neutrino beam from Fermilab has huge scienti_c discovery potential including the conclusive discovery of leptonic CP violation and the determination of the neutrino mass ordering. DUNE will extend the sensitivity to proton decay while simultaneously studying atmospheric and astrophysical neutrinos with very high statistics. The major technological advancement proposed by the dual phase LAr-TPC relies on the charge ampli_cation in argon vapour which provides excellent signal-to-noise ratio. Electrons produced in the liquid argon are extracted to the gas phase where they are multiplied by large area LEMs (Large Electron Multipliers) and collected on an an-ode plane with strip readout. The charge ampli_cation enables constructing giant LAr-TPCs with drift lengths of over 10 m without deteriorating its imaging performance. Dual phase LAr-TPCs have been under development for the past decade. More recently the WA105 collaboration has undertaken an intensive R&D activity to demonstrate the technology at the tens of kiloton scale. All those developments are taking place at CERN who is playing a very active role in LAr-TPC prototyping for DUNE and other experiments. A TPC with 5 ton (3_1_1m3) of active mass has been constructed and recently provided its _rst cosmic ray data. In parallel a much larger 300 ton (6 _ 6 _ 6m3) detector is being assembled in a test beam area. We will review in detail the status and advancement of both those detectors and how they _t in the general context of DUNE.