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DUNE –Precision Neutrino Observatory of the Future

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Summary

Neutrinos are the most abundant matter, but most mysterious, particle in the universe. Contrary to the predictions of the Standard Model of Particle Physics, they have mass, and they can transition from one type to another. This phenomenon of neutrino oscillations may be different for neutrinos and anti-neutrinos and may help to explain the matter-dominated universe via leptogenesis.

The Deep Underground Neutrino Experiment (DUNE) will be a world-class neutrino observatory and nucleon decay detector designed to answer fundamental questions about the nature of elementary particles and their role in the universe. DUNE will consist of a far detector to be located about 1.5 km underground at the Sanford Underground Research Facility (SURF) in South Dakota, USA, at a distance of 1300 km from Fermilab, and a near detector to be located at Fermilab in Illinois. The far detector will be a modular liquid argon time-projection chamber (LArTPC) with a 40 kton fiducial mass. This LAr technology will make it possible to reconstruct interactions with image-like precision and unprecedented resolution. A high-precision near detector, located 575m from the neutrino source on the Fermilab site, will be used to characterise the intensity and energy spectrum of the world's most intense wide-band neutrino beam.

The underground location of the large DUNE far detector and its excellent energy and spatial resolution will allow also conducting non-accelerator physics programs predicted by GUT models, such as nucleon decay or n-nbar oscillations. Moreover, it will be sensitive to measure of the electron neutrino flux from a core-collapse supernova
providing valuable information on the mechanism of a supernova. This ambitious project involves worldwide contribution and extensive prototyping and testing program to guarantee that all parts of the technology are fully understood and well tested.

We will give an introduction to the experiment and report on the recent status.

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