

NEUTRINOS ON TERRESTRIAL AND GALACTIC SCALES: STATUS REPORT OF THE LONG-BASELINE NEUTRINO EXPERIMENT AT DUSEL

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ABSTRACT

We present a status report on the Long-Baseline Neutrino Experiment (LBNE), which is one of the experiments proposed for the Deep Underground Science and Engineering Laboratory (DUSEL) at the Homestake mine in Lead, South Dakota. The primary goal of the experiment is to measure the composition and spectrum of a beam of neutrinos produced at the Fermi National Accelerator Laboratory about 1300 km east of Homestake. From this measurement we will better understand the fundamental properties of this enigmatic particle and shed light on the fundamental processes that occurred during the earliest moments of the creation of matter in the universe. The very large detector located at DUSEL, which will have a mass of tens or hundreds of kilotons depending on the technology chosen, will also be able to detect neutrinos from distant supernovae and possibly even the so-called “relic” neutrinos from all the supernovae that have occurred throughout the universe in the past billions of years. Another goal of the experiment is the observation of the decay of a proton, which may seem unremarkable until one considers that the current limit on the proton lifetime is more than 10^{23} times greater than the age of the universe.