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MicroBooNE: An exploration of the properties of neutrinos, nucleons, and nuclei[1]

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MicroBooNE is a brand-new experiment at Fermi National Accelerator Laboratory in Batavia, Illinois, that will explore the phenomena of neutrino oscillations, as well as the structure of nucleons (protons and neutrons) and nuclei. A beam of neutrinos, with an average energy of about 1 GeV, will pass through the MicroBooNE apparatus on the Fermilab campus. The apparatus consists of a large liquid-argon time-projection chamber (LArTPC), with an active volume 10.4 meters in length along the beam direction, 2.3×2.5 meter^2 transverse to the beam, and containing 89 tons of liquid argon. The LArTPC technology allows for extremely detailed charge-particle tracking and calorimetry. In addition to the TPC, there are also 32 photo-multiplier tubes inside the cryostat to observe the very bright ultraviolet scintillation light produced by the passage of charged particles though liquid argon. The interactions recorded between the neutrino beam and the argon nuclei will provide us with new information about the fascinating phenomenon called "neutrino oscillation" wherein a neutrino of one type (electron, muon, or tau) changes into a neutrino of another type as it travels through space. We will also use the neutrino beam as a probe of the internal structure of the protons and neutrons, exploring in particular the contribution of strange quarks to the intrinsic spin of the nucleon. In addition, it will also be possible to explore short-range correlations in the motion of protons and neutrons inside the argon nucleus. This talk will discuss these physics programs and review the current status of the MicroBooNE experiment.

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