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The LUX Dark Matter Experiment: Design, Calibration, and Simulation

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The LUX (Large Underground Xenon) experiment will attempt to directly detect the WIMP (Weakly Interacting Massive Particle), or, in the case of no signal, produce improved, world-class limits on the WIMP-nucleon interaction cross-section. The detector is two-phase, utilizing an electric field to drift charge liberated by a recoil event in the liquid, producing additional scintillation in the gas. The ratio of primary (liquid) to secondary (gas) scintillation is the basic means for discriminating between electron and nuclear recoils. The liquid portion is 350 kg (100 kg fiducial) in mass, providing excellent self-shielding, augmented by a water shield. The detector is currently deployed above ground at the Sanford Surface Lab for initial testing prior to underground deployment at Homestake, which is scheduled to begin in late 2011. Various internal and external sources of neutrons and gammas will be used to calibrate the detector, coupled with comprehensive and rigorous Monte Carlo simulations. Results will be presented from simulating full detector geometry and incorporating relevant scintillation and ionization physics for xenon.

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