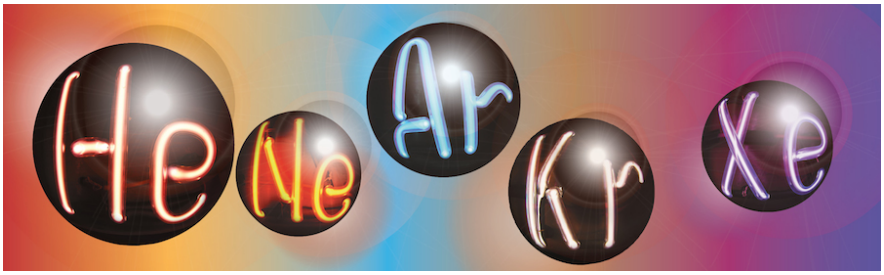

Contribution ID: **17** Type: **Presentation**

Liquid xenon scintillation measurements and pulse shape discrimination in the LUX dark matter detector

Friday 22 September 2017 10:15 (15 minutes)

The Large Underground Xenon (LUX) experiment is a 250kg, dual-phase xenon time projection chamber (TPC) located in the Sanford Underground Research Facility in Lead, South Dakota, USA. The experiment searches for nuclear recoils (NR) that may be caused by Weakly Interacting Massive Particles (WIMPs), a leading candidate for the dark matter content of the universe. Residual backgrounds due to gamma rays and beta decays inside the detector create electronic recoils (ER) that must be identified to maximize sensitivity to rare NR events. Typically, particle-type identification is accomplished using the ratio of collected ionization charge to scintillation light. We present here an analysis of LUX calibration data that studies the time structure of the liquid xenon scintillation pulse in an attempt to improve ER/NR separation by adding pulse shape discrimination (PSD). Using a template-fitting algorithm for photon counting and timing, we reconstruct average pulse shapes for ER/NR pulses. Our spectra are fit to an analytic model of liquid xenon scintillation emission, allowing us to infer the ratio of singlet/triplet state emission for both NR and ER at energies relevant to dark matter searches. In addition, we calculate the pulse-shape discrimination power in LUX as a function of the size of the scintillation pulse. Our analytic model can inform simulation packages used by the larger liquid xenon community, and our measurements will inform future analyses of LUX data. We will discuss our results, as well as the challenges and applications of PSD in current and future liquid xenon TPC dark matter experiments.

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