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LBECA: Sub-GeV Dark Matter Search with Xenon

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The LBECA collaboration plans to optimize xenon time projection chamber (TPC) sensitivity to sub-GeV dark matter by focusing on few-electron ionization signals. Previous experiments such as XENON1T and LUX have observed an increase in few-electron backgrounds up to 100s of milliseconds after energetic particle interactions, which limits their sensitivity to such low-energy interactions. The exact origin of these signals is currently unknown, but hypotheses include delayed extraction of ionization electrons from the liquid-gas interface and trapping of charges on electronegative impurities. LBECA looks to investigate and reduce this background through several methods, such as reduction of impurities through novel detector construction and materials, and improved electron extraction through infrared stimulation or increased extraction field. Small xenon TPCs are currently being operated at different institutions (LBNL, LLNL, Purdue, UCSD) to explore the origins of these backgrounds and implement reduction strategies, while colleagues at Stony Brook complement the work with simulation and modeling. LBECA will combine technological improvements to achieve world-leading sensitivity to sub-GeV dark matter interactions using a dedicated liquid xenon TPC.

Author: CLARK, Michael Takashi (Purdue University)

Co-author: LANG, Rafael

Presenter: CLARK, Michael Takashi (Purdue University)

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