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Improving sensitivity to low-mass dark matter in LUX using a novel electrode background mitigation technique

Tuesday, May 25, 2021 8:06 AM (18 minutes)

For dual-phase xenon time projection chambers such as LUX, signatures of low-mass DM interactions would be ∼keV scatters that ionize only a few xenon atoms and seldom produce detectable scintillation signals. In this regime, extra precaution is required to reject a complex set of low-energy backgrounds that have long been observed in this class of detector. Noticing backgrounds from the electrodes were particularly prevalent, a machine learning technique based on ionisation pulse shape was developed to identify and reject these events. The technique was shown to improve Poisson limits by a factor of 2-7, and was applied to LUX events in an effective 5 tonne·day exposure to place strong limits on DM with masses $m_\chi \in 0.15$-10 GeV. The machine learning technique is expected to be useful for near-future experiments, such as LZ and XENONnT, which hope to perform low-mass DM searches with the stringent background control necessary to make a discovery.

TIPP2020 abstract resubmission?

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Primary author: Ms OLIVER-MALLORY, Kelsey (Imperial College London)

Presenter: OLIVER-MALLORY, Kelsey (Imperial College London)

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