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Low Mass WIMP searches with the Migdal Effect in XLZD

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XLZD is a future dark-matter direct detection experiment that will use a liquid Xenon (LXe) based Time Projection Chamber (TPC) to search primarily for Weakly Interacting Massive Particles (WIMPs), with sensitivity all the way to the neutrino-fog for WIMP candidates with mass above about 3 GeV/cˆ2. The typical channel used to search for these particles is through their recoil on the nuclei of the xenon atoms producing both light and charge signals, that are collected using photomultiplier tubes (PMTs). This channel has been used by current generation LXe TPC experiments to set world leading limits on the WIMP-nucleon cross section for WIMP masses above 3 GeV/cˆ2. The recoil signals produced by even lower mass WIMPs are typically lower than the detection threshold leading to much of the phase-space remaining unexplored.
In this talk I will present the prospects of utilizing possible signals from the Migdal Effect to search for Low Mass WIMPs in XLZD. According to the Migdal Effect, the electron cloud of a target atom may lag behind a recoiling nucleus which may lead to some electrons being emitted. Since electrons produce electronic recoil signals, with a larger charge to light ratio and less energy lost to heat, low mass WIMPs (0.1 GeV/cˆ2 to 2 GeV/cˆ2) can also produce signals that are larger than the detection threshold. When searching for signals near the detection threshold, instrumental noise like the mispairing of waveforms becomes a major background. In my talk, I will summarize the XLZD experiment and how the sensitivity to WIMP interactions with this channel vary considering different sizes of the detector, levels of backgrounds and the strength of the electric field in the future TPC.

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