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Experimental search for the Migdal Effect in a compact liquid xenon TPC

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Direct dark matter searches have reported dramatically increased sensitivity to sub-GeV parameter space by taking into account the “Migdal Effect”, a predicted inelastic process in which a neutral particle scattering with a nucleus results in the ejection of a bound electron from the recoiling atom. However, the Migdal Effect has never been experimentally observed, and should be confirmed and characterized before a potential dark matter signal in this channel can be reliably discovered. In this talk, we report on a dedicated experimental campaign to search for the Migdal Effect using neutron scattering in a small liquid xenon detector at Lawrence Livermore National Laboratory. Scattered neutrons are detected by a ring of liquid scintillator detectors at fixed angle, providing a high-statistics sample of 7 ± 1.5 keV nuclear recoils in the liquid xenon. We search for nuclear recoil events with an electronic recoil component consistent with atomic excitation from the Migdal Effect. We find no evidence for a signal consistent with predictions, and discuss possible explanations for this discrepancy. Our results, while inconclusive, provide important input into future experimental studies of the Migdal Effect.

Early Career

Yes

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