

Directionality for nuclear recoils in a liquid argon Time Projection Chamber

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Liquid argon (LAr) is one of the most promising targets for the search of WIMP-like dark matter. LAr dual-phase time projection chamber (LAr TPC) is a leading technology, able to detect both the scintillation and ionization signals. The correlation in the two signal channels provides a possible handle to measure the recoil direction of the nuclei: if confirmed, this would allow inferring the incident direction of potential dark matter candidates.

Previous work from SCENE resulted in a hint of the existence of a directional effect, which can potentially pave the way for a tonne scale directional WIMP search with LAr TPC. To validate this hypothesis, we conducted the Recoil Directionality (ReD) experiment to measure this correlation in 70 keV nuclear recoils to the highest precision.

The ReD TPC was carefully calibrated then irradiated with a neutron beam at the INFN Laboratori Nazionali del Sud, Catania, Italy. A model based on directional modulation in charge recombination was developed to explain the correlation. In this contribution, we describe the experimental setup, the theoretical model, and the preliminary results from data analysis.

Reference to paper (DOI or arXiv)

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Primary author(s) : LI, Xinran (Lawrence Berkeley National Laboratory)

Presenter(s) : LI, Xinran (Lawrence Berkeley National Laboratory)

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