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Reconstructing Double Neutron Scatters in XENON1T

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Many dark matter search experiments active today, and to be activated in the future, utilize xenon as a target mass in dual phase time projection chambers (TPC). Although xenon has seen widespread use in liquid noble gas detectors, and is currently employed by the XENON1T, LUX, and PandaX-II detectors; the process of energy deposition for nuclear recoils in liquid xenon is not precisely understood. This process has been described from first principles and measured precisely in the cases of liquid helium and argon, but this remains prohibitively difficult in the case of liquid xenon. The XENON1T detector possesses an external mono-energetic neutron source via deuterium-deuterium plasma fusion, producing neutrons with peaks at 2.2 Mev and 2.7 Mev. This research aims to reconstruct double scatter events using these mono-energetic neutrons, thus providing valuable information to constrain present understanding of energy deposition for nuclear recoils in liquid xenon.

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