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Signatures of Dark Matter Scattering Inelastically Off Nuclei

Direct dark matter detection focuses on elastic scattering of dark matter particles off nuclei. In this poster, we investigate inelastic scattering in which the target nucleus is excited to a low-lying state of ˜10-100 keV, with a subsequent prompt de-excitation. We calculate the inelastic structure factors of the odd-mass xenon isotopes based on state-of-the-art large-scale shell-model calculations with chiral effective field theory WIMP-nucleon currents. For these cases, we find that the inelastic channel is comparable to or can dominate the elastic channel for momentum transfers ˜150 MeV. We calculate the inelastic recoil spectra in the standard halo model and compare them to the elastic case. We then discuss the expected signatures in a liquid xenon detector, such as XENON1T, along with implications for current and future experiments. XMASS has provided first limits on WIMP scattering off Xe-129 that are derived exclusively from data of inelastic scattering.

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