

Dark matter direct detection from single phonons to nuclear recoils

Thursday 30 March 2023 17:00 (15 minutes)

In most direct detection experiments, the free nuclear recoil description of dark matter scattering breaks down for masses $\gtrsim 100$ MeV, or when the recoil energy is comparable to a few times the typical phonon energy. For dark matter lighter than 1 MeV, scattering via excitation of a single phonon dominates and has been computed previously, but for the intermediate mass range or higher detector thresholds, multiphonon processes dominate and are challenging to compute. In this talk, I present an analytic description of dark matter scattering that connects the single phonon, multiphonon, and the nuclear recoil regimes. I discuss the theoretical assumptions of the calculation and present results for dark matter in the keV-GeV mass range.

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Session Classification: SESSION 9: Dark Matter Theory (CHAIRS: Volodymyr Takhistov- QUP-KEK, Japan, and Edoardo Vitagliano- Hebrew U. of Jerusalem, Israel)

Track Classification: Dark matter theory