

# Multiphonon excitations from dark matter scattering in crystals

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For direct detection of sub-MeV dark matter, a promising strategy is to search for individual phonon excitations in a crystal. We perform an analytic calculation of the rate for light dark matter ( $\text{keV} < m_{\text{DM}} < \text{MeV}$ ) to produce two acoustic phonons through scattering in cubic crystals such as GaAs, Ge, Si and diamond. The multiphonon rate is always smaller than the rate to produce a single optical phonon, whenever the latter is kinematically accessible. In Si and diamond there is a dark matter mass range for which multiphonon production can be the most promising process, depending on the experimental threshold.

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