Abstract Submitted
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Excitation Profile of Bi_2Se_3, Bi_2Te_2Se, and Bi_2Te_3 Single Crystals by Raman Scattering[1] ALEXANDER LEE, GIRSH BLUMBERG, HSIANG- HSI KUNG, SANG-WOOK CHEONG, Rutgers University, New Brunswick, ROBERTO MERLIN, IBRAHIM BOULARES, University of Michigan — Topological Insulators are a class of materials where strong SO coupling results in an insulating bulk and the formation of exotic Dirac fermion metallic surface states. The Raman cross section as a function excitation energy provides information about resonance conditions for interband transitions. Here, we present the results of Raman scattering experiments on Bi_2Se_3, Bi_2Te_2Se, and Bi_2Te_3 single crystals. We present the excitation profile of the phonon intensities of these materials in the visible regime (1.65–3.1eV), corrected for optical constants and spectrometer response, and demonstrate that the cross section for the bulk and surface phonons peaks close to/at the same energy. This indicates that surface resonance effects are responsible for the surface mode intensity increase. Furthermore, we demonstrate that the bulk phonons follow the standard anharmonic decay model as a function of temperature, whereas the surface modes show significant deviation from this model. Electron-phonon interaction may be a major scattering mechanism for Dirac fermions; therefore, a systematic understanding of the behavior of surface phonons in these materials at finite temperatures is important for their applications to spintronic devices.

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Alexander Lee
Rutgers University, New Brunswick

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