Abstract Submitted
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Effect of film thickness on ultrafast carrier relaxation rates in thin-films of the topological insulator Bi_2Se_3[1] YURI D. GLINKA, SERCAN BABAKIRAY, TRENT A. JOHNSON, ALAN D. BRISTOW, MIKEL B. HOLCOMB, DAVID LEDERMAN, Department of Physics and Astronomy, West Virginia University — Transient reflectivity measurements of thin films, ranging from 6 to 40 nm in thickness, of the topological insulator Bi_2Se_3 reveal a strong dependence of the ultrafast carrier relaxation rate on the film thickness. We exploit this behavior to distinguish between the contributions from the bulk 3D states and the 2D gapless surface states. Based on experimental observations we conclude that there is a crossover between two carrier relaxation mechanisms associated with the polar phonon (Frohlich) interaction in the bulk insulating phase and the electron-lattice interaction in the surface metallic phase. It is suggested that this crossover could be a result of hybridization of Dirac cone states at the opposite surfaces of the thinnest films.

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