Abstract Submitted
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Time-resolved terahertz dynamics in thin films of the topological insulator Bi_2Se_3 ROLANDO VALDÉS AGUILAR[1], J. QI, A.J. TAYLOR, D.A. YAROTSKI, R.P. PRASANKUMAR, Center for Integrated Nanotechnologies, Los Alamos National Laboratory, NM 87545, M. BRAHLEK, N. BANSAL, S. OH, Department of Physics & Astronomy, Rutgers University, Piscataway NJ 08854 — Experiments at terahertz frequencies (1 THz $\sim$ 4 meV) in thin films of Bi_2Se_3 have provided evidence of the surface response, and give a picture of relatively mobile surface carriers with a bulk response that makes a small contribution to the THz conductivity. In this report we use optically pumped time-resolved THz spectroscopy at low temperature to distinguish the bulk and surface contribution on thin films of Bi_2Se_3 of several thicknesses. We find that for very thin films, where pure 2D behavior is expected, the optical pump induces a change in the 2D transport scattering rate which decays in a time-scale of 20 picoseconds. For thicker films, we see an additional contribution that increases the conductivity and scales with the increase in both the film thickness and the fluence of the pump beam. This contribution has much faster rise and decay times of approximately 5 ps, as well as a much larger scattering rate than the previously identified surface term. The different dynamics between surface and bulk electrons close to the Fermi energy evidenced in this study indicate a decoupling of surface and bulk carriers at low temperature, and present the possibility of accessing long-lived surface photo-carriers for optoelectronic applications.

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