Abstract Submitted
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Quantum Interference Control of Currents in Bi_2Se_3 Topological Insulators[1] DEREK BAS, West Virginia University — Quantum interference control of photocurrents are investigated in Bi_2Se_3 films ranging from 6 to 40 quintuple layers in thickness. The samples are grown with a two-step method on sapphire substrates and protected with an MgF_2 capping layer that prevents oxidation. Co-polarized harmonically related pulses excite carriers through interference of single- and two-photon absorption pathways, which have a polar distribution in momentum space leading to a ballistic photocurrent. The current is measured using time-domain terahertz spectroscopy. Dependences of the relative phase between the two pulses and intensity of each pulse show the correct signatures confirming the third-order nonlinear quantum interference control. Azimuthal angle dependence allows the injection current to be separated from a relative-phase independent shift current generated by the fundamental pulses alone. The shift current is a second-order nonlinear optical process arising from the surface states, while the injection current arises from surface-to-surface transitions at an energy of 1.6 eV. A thickness dependence of the injection current in the Bi_2Se_3 film is dominated by the product of the linear and nonlinear absorption. The two-photon absorption coefficient is explored as a function of film thickness for the first time.

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