Toward ultrafast control of Dirac electrons: photoexcitation & coherent phonons in topological semimetals

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Abstract

In the newly-discovered Dirac and Weyl semimetals, electrons' dispersions cross masslessly at a node, giving the materials many exotic electronic and optical properties. The ability to controlably open or close a gap at the Dirac node would allow experimenters to manipulate many of the materials' exotic properties at will, and ultrafast control of the node would allow these properties to be turned on or off in a flash. I will describe our efforts to use the vibration of a coherent phonon for sub-picosecond control of the Dirac node in the semimetal SrMnSb2. I will also describe our studies of the ultrafast thermodynamics of photoexcited electrons and holes in Dirac and Weyl semimetals.