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(I) Theoretical modeling of topological microelectronic devices with van Roosbroeck's equations

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Van Roosbroeck's equations constitute a versatile tool to determine the dynamics of electrons under time- and space-dependent perturbations. Extensively utilized in ordinary semiconductors, their potential to model devices made from topological materials remains untapped. In this talk, we will adapt van Roosbroeck's equations to theoretically study the bulk response of a Weyl semimetal to an ultrafast and spatially localized light pulse in the presence of a quantizing magnetic field. We predict a transient oscillatory photovoltage that originates from the chiral anomaly. The oscillations take place at the plasma frequency (THz range) and are damped by intervalley scattering and dielectric relaxation. Our results illustrate the ability of van Roosbroeck's equations to unveil the interplay between electronic band topology and ultrafast carrier dynamics in microelectronic devices.

Keyword-1

Topological materials

Keyword-2

Van Roosbroeck equations

Keyword-3

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