Electronic and transport properties of topological insulators

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We study the electronic and transport properties of various topological insulators. Topological insulators (TI) [1] are new materials, which posses many properties interesting for both applied and fundamental physics. In the following work, we analyze the Su-Schrieffer-Heeger model for polyacetylene [2], which can be understood as a 1D TI, graphene nanoribbons with spin-orbit interaction [3], and CdTe/HgTe quantum wells [4]. For infinitely long nanoribbons we present band structures and their modification due to external potentials. In case of a finite systems, the conductance and eigenenergy spectra are presented within tight-binding approach. We investigate the effect of various types of disorders and external potentials. The effect of electron-electron interaction in graphene systems will be considered.

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