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Modelling of the transport properties of topologically protected edge states XIAOQIAN DANG, J.D. BURTON, EVGENY TSYMBAL, Univ of Nebraska - Lincoln — One of the great successes of modern condensed matter physics is the discovery of topological insulators (TI). A thorough investigation of their transport properties, along with proposed device geometries, could bring such materials from fundamental research to potential applications. Here we report on theoretical investigations of transport properties of simple systems which incorporate TIs and their protected edge states. We utilize the tight-binding form of the Bernevig-Hughes-Zhang model [1] as a prototype for generic topological insulators. Transport properties are investigated theoretically by constructing the Green's functions and employing the Landauer-Büttiker formalism. We study the limitations to scattering-free transport around defects/impurities through topologically protected edge states, as well as the prospect of metal-TI-metal tunnel junctions where the protected edge states reside between the metal electrode and the insulating bulk of the TI. Elucidating the fundamental physical effects that occur in these (and other) systems will be an integral step in establishing TIs as a building block for potential electronic device applications.

[1] B. A. Bernevig *et al.*, *Science*, **314**, 1757 (2006).

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