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Dimensional crossover of transport characteristics in topological insulator nanofilms KEN-ICHIRO IMURA, YUKINORI YOSHIMURA, Hiroshima University, KOJI KOBAYASHI, TOMI OHTSUKI, Sophia University — Recently, much effort has been made to grow thin films of a topological insulator. Naturally, its primary purpose was to reduce the contribution of the bulk to transport quantities. Here, we propose that searching for quantized transport in such TI thin films is an efficient way for probing non-trivial topological features encoded in the 3D bulk band structure. In a recent work (Kobayashi, KI, Yoshimura & Ohtsuki, arXiv:1409.1707), we have highlighted the following issues: 1) Transport characteristics of TI thin films is well understood by studying the conductance both in the edge and slab geometries. 2) We introduce “conductance maps” for revealing the dimensional crossover in such TI thin films. Quantization of the conductance occurs both in the edge and in the slab geometries, but not at the same time. 3) We focus on the even-odd feature in transport with respect to the number of stacked layers. We found parameter regimes in which the even-odd feature is broken by inversion of the finite-size gap associated with hybridization of the top and bottom surface wave functions. We propose that tuning the hybridization gap of a TI thin film and make it inverted is an effective way of realizing a 2D quantum spin Hall state.

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