Z_2 Topological Anderson Insulator

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We report our recent study[1] on the effects of disorder on two-dimensional Z2 topological insulator using the transfer matrix method. Based on the scaling analysis, the phase diagram is derived for a model of HgTe quantum well as a function of disorder strength and magnitude of the energy gap. In the presence of sz non-conserving spin-orbit coupling, a finite metallic region is found that partitions the two topologically distinct insulating phases. As disorder increases, a narrow-gap topologically trivial insulator undergoes a series of transitions; first to metal, second to topological insulator, third to metal, and finally back to trivial insulator. We show that this multiple transition is a consequence of two disorder effects; renormalization of the band gap, and Anderson localization. The metallic region found in the scaling analysis corresponds roughly to the region of finite density of states at the Fermi level evaluated in the self-consistent Born approximation.

[1]A. Yamakage, Ken Nomura, K.-I. Imura, Y. Kuramoto, JPSJ Letter in press, arXiv:1011.5576.