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Zero field conductance singularity in two terminal ferromagnet-topological insulator device[1] XIAOPENG DUAN, YURIY G. SEMENOV, KI WOOK KIM, North Carolina State Univ — Spin-momentum interlocking of surface electronic states on 3D topological insulator (TI) grants the unique opportunity to generate electric current directed according to the spin polarization of injected electrons instead of the applied electric field. Such asymmetry in momentum distribution of injected electrons takes place in the vicinity of ferromagnetic contact but vanishes on the length of few mean free passes. We propose to use this property in two terminal devices consisting of two parallel ferromagnetic contacts deposited on the surface of 3D TI. When the injected spin polarization leads to electron momentum pointing towards the other electrode, it facilitate the direct transmission, resulting in a lower resistance; in contrast with a reversed bias, the spin-determined momentum points away from the other electrode, because of which the electrons could gain the right momentum only after multiple scatterings to approach the second electrode, thus resulting in a higher resistance. We stress that this asymmetry in the resistance keeps up to arbitrarily small applied voltage since it does not need the formation of space charge region that is essential in conventional diodes. The rectification ratio near zero voltage are estimated and potential application are discussed.

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