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Electrically controllable surface magnetism on the surface of topological insulator[1] JIA-JI ZHU, SKLSM, Institute of Semiconductors, Chinese Academy of Sciences, DAO-XIN YAO, School of Physics and Engineering, Sun Yat-sen University, SHOU-CHENG ZHANG, Department of Physics, Stanford University, KAI CHANG[2], SKLSM, Institute of Semiconductors, Chinese Academy of Sciences — We study theoretically the RKKY interaction between magnetic impurities on the surface of a three dimensional topological insulator, mediated by the massless and massive helical Dirac electrons. Exact analytical expression of RKKY interaction shows that the spin- spin interaction consists of the Heisenberg-like, Ising-like and Dzyaloshinskii-Moriya (DM)-like terms caused by the helicity of the topological surface states. It provides us a new way to realize various spin models, e.g., DM model, XXZ model and XZ model, and control surface magnetism by tuning the Fermi energy, and/or the distance between the two local spins. The gap opened by doped magnetic ions can lead to a short-range Bloembergen- Rowland interaction via the virtual interband interaction when the Fermi energy is located in the gap. The competition among the Heisenberg, Ising and DM terms leads to rich spin configurations and anomalous Hall effect on different lattices.

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