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Effective spin dephasing mechanism in confined two-dimension topological insulators JUNJIE QI, Institute of Physics, Chinese Academy of Sciences, Beijing 100190, China, HAIWEN LIU, International Center for Quantum Materials and School of Physics, Peking University, Beijing 100871, China, HUA JIANG, College of Physics, Optoelectronics and Energy, Soochow University, Suzhou 215006, China, X.C. XIE, International Center for Quantum Materials and School of Physics, Peking University, Beijing 100871, China, XIE'S GROUP TEAM — A Kramers pair of helical edge states in quantum spin Hall effect (QSHE) is robust against normal dephasing but not robust to spin dephasing. In our work, we provide an effective spin dephasing mechanism in the puddles of two-dimension QSHE, which is simulated as quantum dots modeled by 2D massive Dirac Hamiltonian. We demonstrate that the spin dephasing effect can originate from the combination of the Rashba spin-orbit coupling and electron-phonon interaction, which gives rise to inelastic backscattering in edge states within the topological insulator quantum dots, although the time-reversal symmetry is preserved throughout. Finally, we discuss the tunneling between extended helical edge states and local edge states in the QSH quantum dots, which leads to backscattering in the extended edge states. These results can explain the more robust edge transport in InAs/GaSb/AlSb QSH systems.

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