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Quantum criticality in Kondo quantum dot coupled to helical edge states of interacting 2D topological insulators[1] CHUNG-HOU CHUNG, SALMAN SILOTRI, Department of Electrophysics, National Chiao-Tung University, HsinChu, Taiwan, R.O.C. — We investigate theoretically the quantum phase transition (QPT) between the one-channel Kondo (1CK) and two-channel Kondo (2CK) fixed points in a quantum dot coupled to helical edge states of interacting 2D topological insulators (2DTI) by tuning Kondo couplings at a fixed Luttinger parameter $K < 1$. The system can be mapped onto an anisotropic two-channel Kondo Hamiltonian, and the 2CK fixed point was argued to be stable for infinitesimally weak tunnelings between dot and the 2DTI. We re-examine this model beyond the bare scaling dimension analysis via a controlled perturbative renormalization group (RG) approach combined with bosonization and re-fermionization techniques near weak-coupling and strong-coupling (2CK) fixed points. For K close to but less than 1, we find the 2CK fixed point can be unstable towards the 1CK fixed point and the system is expected to undergo a quantum phase transition between 1CK and 2CK fixed points. Our system serves as the first example of the 1CK-2CK QPT that is accessible by the controlled RG approach though this transition has been known to exist in Kondo dot coupled to two conventional Luttinger liquid leads with a critical value $K_c = 1/2$. We extract quantum critical and crossover behaviors from various observables near criticality.

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