Transport via single and double quantum point contacts in 2D topological insulators

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We study transport properties of the helical edge states of 2D integer and fractional topological insulators (TI/ FTI), via one and two constrictions (quantum point contacts). Such constrictions can be made by adding a gate to the systems where the coupling between edge states on either side of 2D sample is electronically tuned by this gate. We study the stability of both the conducting (weak backscattering limit) and insulating fixed points (weak tunneling limit). Moreover, we explore interesting physics when double impurity is on resonance, leading to perfect transmission (weak backscattering limit) and Kondo physics (weak tunneling limit). Using renormalization group and duality mapping, we analyze phase diagrams for the following cases: (i) single constriction in FTI, which is a generalization of the single constriction in TI studied by J. Teo and C. Kane. (ii) two constrictions in TI, and (iii) two constrictions in FTI. We find different behaviors depending on interaction strength and particularly a regime where conductance is non-monotonic as a function of temperature in the experimentally accessible parameter regime