Microwave Transport in Quantum Anomalous Hall Edge States

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Magnetically doped topological insulators such as V-doped $(Bi_xSb_{1-x})_2Te_3$ (V-BST) show the quantum anomalous Hall (QAH) effect, and exhibit a quantized Hall conductance without an applied external magnetic field. Owing to the presence of a non-zero Chern number, a single chiral edge state emerges at the edge of the QAH material and is topologically protected against disorder and perturbations. Thus, QAH systems open interesting perspectives for realizing miniaturized non-reciprocal microwave components [1] or for generating flying Majorana states [2].

In this context, we report on microwave transport in chiral edge states, which allows for investigating the dispersion and velocity of the edge states. We conduct microwave measurements on devices using V-BST films grown by molecular beam epitaxy, and measure the transmission of the edge states as a function of temperature, magnetic field and frequency. We determine the plasmon velocity and attenuation from the phase and amplitude respectively. Following recent works, we ascribe the interaction with charge puddles as a primary source of dissipation. We describe this interaction with a circuit model and observe a dispersion consistent with findings in similar materials. As such, it provides a potential material platform for coherent electronic transport in chiral edge states and the generation and manipulation of flying Majorana excitations.

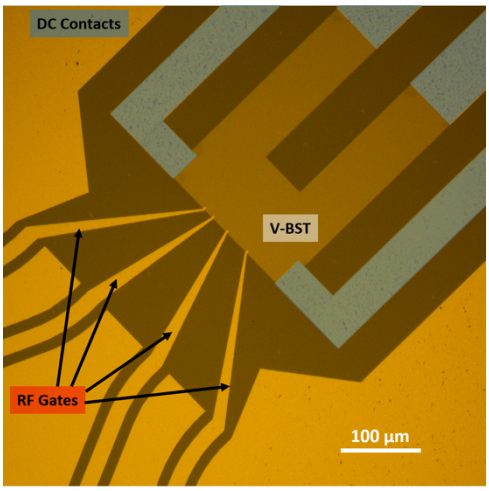

Figure 1 - Optical picture of the sample, with 4 RF gates for excitation and readout, and 4 DC ohmic contacts for characterization

[1] A.C. Mahoney *et al.*, Nature Communications 8, 1836 (2017)
[2] C.W.J. Beenakker *et al.*, Phys. Rev. Lett. 122, 146803 (2019)
[3] T. Röper *et al.*, *in preparation* (2024).