Normal state transport and induced superconductivity in SnTe nanowires

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Tin telluride (SnTe) is a topological crystalline insulator [1] and hosts two-dimensional surface states. Moreover, SnTe is an acknowledged candidate as a higher order topological insulator (HOTI) [2]; this class of materials host hinge states on the boundary of two gapped surfaces, leading to conducting hinges and insulating bulk and surfaces. Thus far, HOTIs have not been experimentally confirmed , and detecting the 2D surface and 1D hinge states in this material is therefore an important fundamental advancement.
We employ both normal state and superconducting devices, to determine the effect of 1D and 2D states on the transport properties of SnTe nanowires. In the normal state, conductance oscillations as a function of source-drain and backgate voltage are attributed to Fabry-Pérot resonances, hinting at (quasi-) ballistic transport through a topological surface or hinge state [3]. Furthermore, we form Josephson junctions using superconducting electrodes to investigate Shapiro patterns and look at the supercurrent distribution in magnetic field. Using both experiments, a distinction between lower dimensional transport and trivial bulk transport can be made [4].

References

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[3] A.V. Kretinin et al., Nano Letters, 10 (2010) 3439-3445
[4] C-Z. Li et al., Phys. Rev. B, 97 (2018) 115446

Figures

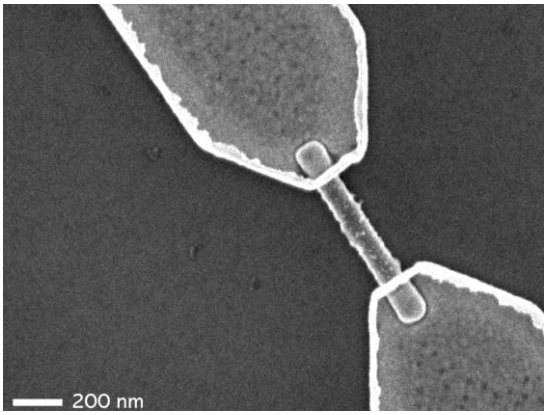

Figure 1: SEM image of the general device architecture, consisting of a SnTe nanowire and contacts. For normal contacts, Ti/Au is used, and for Josephson junctions, Nb/Pd is deposited.

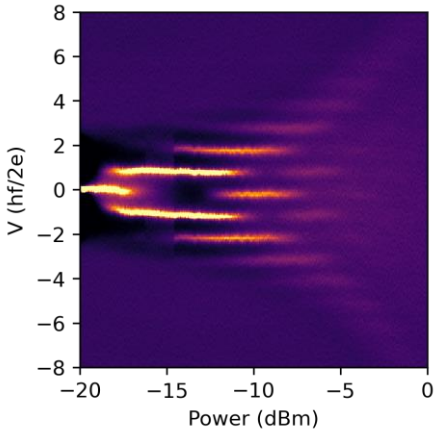

Figure 2: AC Josephson effect, showing at least 6 Shapiro steps, when irradiating the junction with 2.073 GHz microwaves.