Quantum Anomalous Hall Effect Devices for Resistance Metrology

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Abstract: The quantum anomalous Hall effect (QAHE), as manifested in ferromagnetically-doped topological insulator (TI) materials [1, 2] is of high interest in fundamental physics and in metrology. For metrology, the effect has enormous potential because it provides Hall resistance quantization in units of the von-Klitzing constant in zero external magnetic field. We have extensively characterized Hall-bar-shaped devices from V-doped $(BiSb)_2Te_3$ by means of a state-of-the-art precision resistance bridge based on a 14-bit cryogenic current comparator (CCC) at PTB [3]. In comparison with former experiments using a 12-bit CCC bridge, the 14-bit CCC bridge has a significantly improved resolution, especially at low currents in the nA range. Our latest experiments include current and temperature dependent measurements of magneto-transport quantities in the QAHE regime, performed on recently fabricated devices with improved contact technology. The results to be presented at the conference clearly show improved results at higher currents compared to previous investigations on V-doped $(BiSb)_2Te_3$ devices [1].

References

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Figures

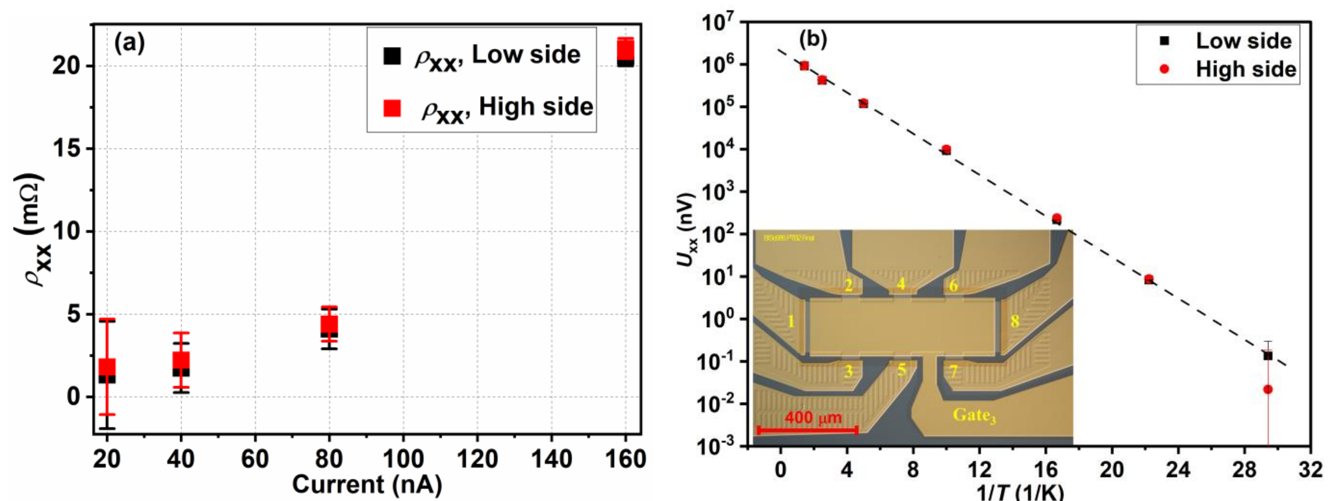

Figure 1: (a) It shows the current dependence of the longitudinal resistivity. (b)Arrhenius plot of the temperature dependent longitudinal voltage obtained at a current of ±40 nA, a gate voltage of 5.8 V and a measurement time of 32 minutes. The inset is the optical image of an as-fabricated device with labled contacts.