# Bulk Reservoir in Oscillatory Charge Transfer and Magnetization of SnTe Topological Crystalline Insulator

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SnTe is known to belong to the family of topological crystalline insulators (TCI) [1-5]. It was predicted that topological surface states with linear Dirac E(k) dispersion surround on all sides the bulk crystal. We demonstrate that bulk SnTe, having very high hole density ($3x10^{20}cm^{-3}$), serves as a reservoir of charge carriers to the system [6]. This results in transfer of holes between SnTe reservoir and the topological surface states in quantizing magnetic field.
We apply a formalism of the grand canonical ensemble for varying number of particles employing density of states in the presence of quantizing magnetic field in order to calculate oscillatory transfer of holes between the reservoir and topological surface states, see Fig. 1. The important element of the model is a pinning of the Fermi energy by the reservoir.
The magnetization was measured by torque magnetometry on bulk parallelpiped sample of high quality SnTe monocrystal. The resulting de Haas - van Alphen (dHvA) effect exhibits two components: one related to the 2D surface states and the other related to the bulk 3D states. Frequencies of the corresponding oscillations determine carrier densities in each subsystem. The above formalism of grand canonical ensemble is used to calculate oscillatory magnetization of holes in the Dirac cones related to TCI, see Fig. 2. In order to verify the topological character of surface dHvA oscillations, we followed the Landau level index plot procedure. The determined Berry phase of π unambiguously indicates that we deal with topological surface states.

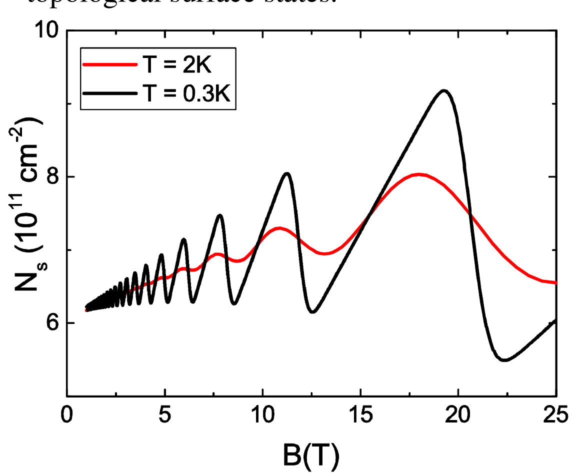


Fig. 1 Oscillations of hole density – theory.

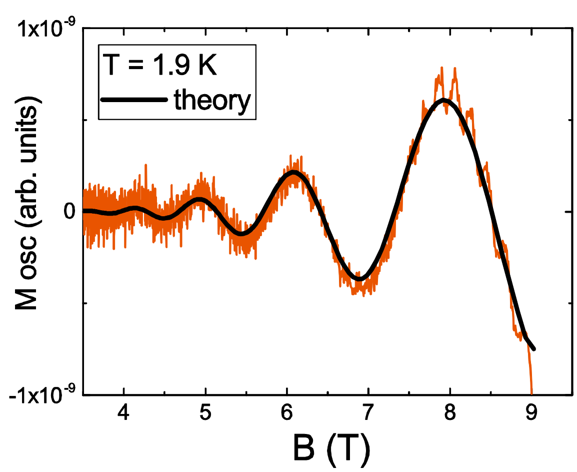


Fig. 2 Oscillations of magnetization.

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