Quantum capacitance and field driven phase transition in hexagonally warped topological insulators

Ultra-thin 3D topological insulators provide a stage to study the surface physics of such materials by minimizing the bulk contribution. The experimentally verified snowflake like structure of the Fermi surface leads to a hexagonal warping term that can be treated as a perturbation in the presence of a magnetic field. This analysis leads to the corrections in both energy dispersion and eigen- states altering the density of states in the presence of a magnetic field. The quantum capacitance has been evaluated analytically and it is shown the zero-temperature quantum capacitance exhibits Shubnikov–de Haas oscillations with reduced frequencies, with a lowered average capacitance with increased warping of the Fermi surface, while maintaining the usual amplitudes. Additionally, the insulator to semi metal phase transition induced by a tilted in-plane magnetic field will be discussed. Moreover, it has been shown that a perpendicular electric field driven semi metal to metal phase transition cannot be annihilated by considering the warping parameter.

References:

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2) A. Menon, D. Chowdhury and B. Basu, Hybridization and field driven phase transitions in hexagonally warped topological insulators –submitted (arXiv: 1605.04500) submitted