Abstract Submitted
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Theoretical studies of surface states in three-dimensional topological-insulator thin films in a strong magnetic field. ANNA PERTSOVA, CARLO M. CANALI, Linnaeus University, 39182 Kalmar, Sweden, ALLAN H. MACDONALD, The University of Texas at Austin, Austin, Texas 78712-0264, USA — The peculiar structure of the Landau levels (LLs) in topological insulators (TIs), in particular the existence of a field-independent (zeroth) LL, is a characteristic signature of the Dirac surface states. However, recently it has been shown that the hybridization between top and bottom surfaces in a 3D TI thin film may lead to a splitting of the zeroth LL and even to its absence in the ultra-thin film limit. We report on microscopic tight-binding modelling of Bi_2Se_3 thin films [1] in the presence of a strong magnetic field. We find that the zeroth LL is absent for thicknesses below 4QLs, in agreement with experiments. Calculations of the LL spectrum of a 5QL-thick slab reveal a strong asymmetry with respect to the Dirac point and a clear signature of the first LL, in good agreement with Dirac-Hamiltonian model calculations. The latter feature persists in a wide range of magnetic fields and involves an extended window of energies, including bulk states away from the Dirac point. We use our results to predict an interplay between the external magnetic field and gate-voltage dependence of the anomalous Hall effect that is characteristic of topological magnetic states.

[1] A.Pertsova and C.M.Canali, arXiv:1311.0691.

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