Abstract Submitted
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Coexistence of Bulk and Surface Shubnikov-de Haas Oscillations in Bi_2Se_3[1] CHI ZHANG, Peking University, FANMING QU[2], Institute of Physics, Chinese Academy of Science, RUI-RUI DU, Rice University, LI LU, Institute of Physics, Chinese Academy of Science — Topological insulator possesses insulating bulk state and spin-momentum interlocked conducting topological surface state. Among many materials, bismuth selenide (Bi_2Se_3) is an important candidate, which hosts a single Dirac cone in the surface energy spectrum. In electron transport measurements, 3-dimensional Shubnikov-de Haas (SdH) oscillations of bulk state were observed. Under a very high magnetic field, our rotating sample experimental results exhibit the coexistence of bulk and surface SdH oscillations: Hall bar shape device based on Bi_2Se_3 nano-plate was fabricated and studied at a dilution temperature with a tilted magnetic field up to 45 T. Three types of carrier, one of 3-dimensional and two of 2-dimensional, were identified by analyzing the angular dependence of SdH oscillations, which confirmed the coexistence of bulk carrier and band bending induced two-dimensional electron gas in transport experiment. The co-contributions to quantum oscillations indicated the independence of these states, without smearing out by scattering with each other, which may pave off the way for studying topological surface states with residual bulk carriers in Bi_2Se_3. The data analysis and experimental results are included in the presentation.

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