Abstract Submitted
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Two-dimensional surface state revealed in the quantum limit of a topological insulator[1] R. MCDONAD, NHMFL/LANL, J. ANALYTIS, SLAC, J.-H. CHU, Standford, S. RIGGS, I. FISHER, Stanford, G. BOEBINGER, FSU/NHMFL — Topological insulators possess a metallic surface state of massless particles, known as Dirac fermions whose spin is coupled to their momentum. The realization of this in Bi2Se3 has sparked considerable interest owing both to the potential for spintronic devices and in the investigation of the fundamental nature of topologically non-trivial quantum matter. However, the conductivity of these compounds tends to be dominated by the bulk of the material owing to chemical imperfection, making the transport properties of the surface nearly impossible to measure. We have systematically reduced the number of bulk carriers in the material Bi2Se3 to the point where a magnetic field can collapse them to their lowest Landau level. Beyond this field, known as the three-dimensional (3D)'quantum limi', the signature of the 2D surface state can be seen. At still higher fields, we reach the 2D quantum limit of the surface Dirac fermions. In this limit we observe an altered phase of the oscillations, which is related to the peculiar nature of the Landau quantization of topological insulators at high field. Furthermore, we observe quantum oscillations corresponding to fractions of the Landau integers, suggesting that correlation effects can be observed in this new state of matter.

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