2D layered transport properties from topological insulator Bi_2Se_3 single crystals and micro flakes
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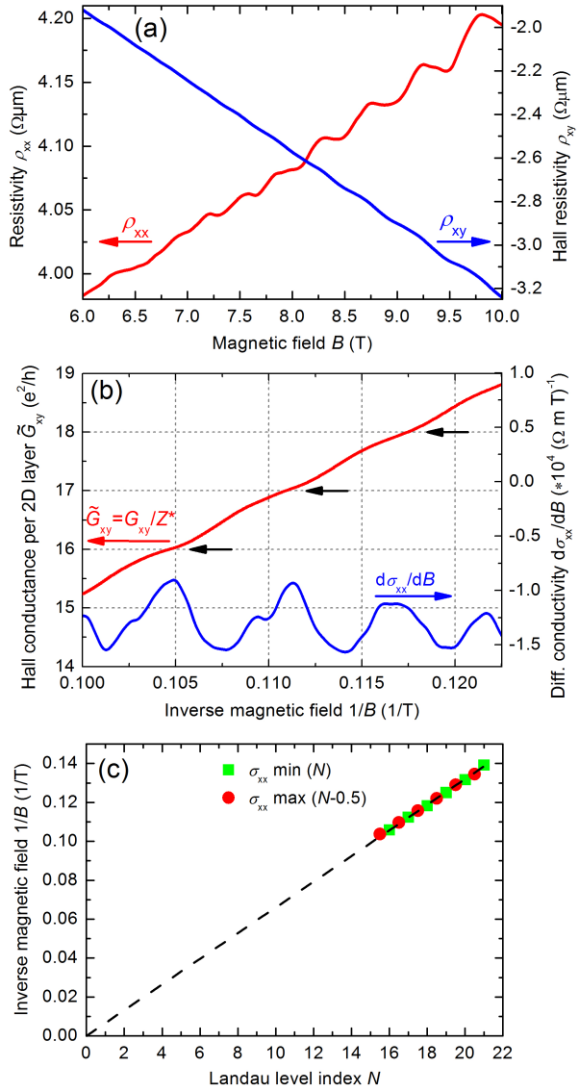
Short Abstract

Low-field magnetotransport measurements of topological insulators such as Bi2Se3 are important for revealing the nature of topological surface states by quantum corrections to the conductivity, such as weak-antilocalization. Recently, a rich variety of high-field magnetotransport properties in the regime of high electron densities were reported, which can be related to additional two-dimensional layered conductivity, hampering the identification of the topological surface states. Here, we report that quantum corrections to the electronic conduction are dominated by the surface states for a semiconducting case, which can be analyzed by the Hikami-Larkin-Nagaoka model for two coupled surfaces in the case of strong spin-orbit interaction. However, in the metallic-like case this analysis fails and additional two-dimensional contributions need to be accounted for.



Left. (**a**) Resistivity ρ_{xx} (red curve, left axis) and Hall resistivity ρ_{xy} (blue curve, right axis) vs magnetic field B of the Bi_2Se_3 macro flake with a thickness of t=110 μm at T=0.3 K. (**b**) Hall conductance per 2D layer $\tilde{G}_{xy}=G_{xy}/Z^*$ in units of e^2/h (red curve, left axis), with measured conductance $G_{xy}=1/R_{xy}$ and Z^*=57500, and $d\sigma_{xx}/dB$ (blue curve, right axis) vs inverse magnetic field $1/B$ at T=0.3 K. The black arrows indicate the QHE plateaux. (**c**) Landau level (LL) fan diagram at T=0.3 K. The $1/B$-positions of the minima and maxima of $\sigma_{xx}(B)$ are shown as a function of the corresponding LL level indices N and $N-0.5$, respectively. The dashed line represents a linear fit to the data, yielding a slope B_f=151 T and an intercept close to zero.