Exotic Effects of Spin-Flip Scattering on Massive Dirac Fermions

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QIAN NIU, The University of Texas at Austin — We investigate the effects of
spin-flip scattering on the Hall transport and spectral properties of massive Dirac
fermions. We find that in the weak scattering regime, the Berry curvature dis-
tribution is dramatically compressed in the electronic energy spectrum, becoming
singular at band edges. As a result the Hall conductivity suffers a sudden jump (or
drop) of $e^2/2h$ when the Fermi energy sweeps across the band edges, and otherwise
is a constant quantized in units of $e^2/2h$. In parallel, spectral properties such as
the density of states and spin polarization are also greatly enhanced at band edges.
Possible experimental methods to detect these effects are discussed.

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