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Band Collapse as Route to Odd-Integer Quantum Hall Effect In Graphene B. ANDREI BERNEVIG, TAYLOR HUGHES, HANDONG CHEN, CONGJUN WU, SHOUCHENG ZHANG, Stanford University, STANFORD/SPINAPPS TEAM — The recent Quantum Hall experiments in graphene have confirmed the theoretically well-understood picture of the quantum Hall (QH) conductance in fermion systems with continuum Dirac spectrum. In this paper we take into account the lattice, and perform an exact diagonalization of the Landau problem on the hexagonal lattice. At very large magnetic fields the Dirac argument fails completely and the Hall conductance, given by the number of edgestates present in the gaps of our spectrum, is dominated by lattice effects. As the field is lowered, the experimentally observed situation is recovered through a phenomenon which we call band collapse. As a corollary, for low magnetic field, graphene will exhibit two qualitatively different QHE's: at low filling, the QHE will be dominated by the "relativistic" Dirac spectrum and the Hall conductance will be odd-integer; above a certain filling, the QHE will be dominated by a non-relativistic spectrum, and the Hall conductance will span all integers, even and odd.

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