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Disordered Dirac Fermions in Topological Superconductors and Artificial Graphene: Level Statistics, Chalker Scaling, and Quantum Hall Metal YANG-ZHI CHOU, MATTHEW FOSTER, Physics & Astronomy Department, Rice University — We study a single Dirac fermion in 2D, subject to static vector potential disorder. This model describes the minimal surface state of a topological superconductor with time reversal and spin U(1) symmetries. Most of the zero-energy attributes are already known; in particular, the model is critically delocalized with multifractal wavefunctions. We numerically investigate various properties, especially those related to the finite energy states. The energy levels in the vicinity of zero energy (chiral point) show universal statistics while the multifractal spectra of the zero-energy wavefunction and the dynamical critical exponent reveal non-analyticity at the freezing transition. The two-wavefunction correlations in the chiral region show quantum critical scaling, even in the case of strong disorder. Moreover, we confirm that the finite energy states are delocalized, and their multifractal spectra are consistent with the integer quantum Hall plateau transition. Our model can also be possibly realized in the artificial materials like molecular graphene.

Yang-Zhi Chou
Physics & Astronomy Department, Rice University

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