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View Abstract

CONTROL ID: 3319136

TITLE: Emergent topological phases in synthetic dimensions with low-frequency laser pumping

Abstract Body: In the Floquet-Bloch theory, when a physical system is driven by a strong external optical field, its dynamics can be conveniently represented in a higher dimensional Floquet lattice. Here, we consider the 2D Dirac systems under strong external optical driving. In the low-frequency limit, new topological states of matter emerge in the synthetic 2+1D, including Dirac nodal line, helix nodal lines, and Weyl fermions. In contrast to conventional Floquet topological states under the high-frequency limit, there is no anomalous Hall signal observed in this system although the time-reversal symmetry is broken and the Floquet energy gap opens at the crossing point. Furthermore, we use the quantum Liouville equation with phenomenological dissipation to simulate the evolution of 2D Dirac fermions under the strong optical field with low frequency, we confirm the existence of the Floquet states and find the simulated transport properties consistent with our prediction from Floquet theory in synthetic 2+1D.

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