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Topological gaps without masses in driven graphene-like systems[1]

THOMAS IADECOLA, Boston University, TITUS NEUPERT, Princeton University, CLAUDIO CHAMON, Boston University — We illustrate the possibility of realizing band gaps in graphene-like systems that fall outside the existing classification of gapped Dirac Hamiltonians in terms of masses. As our primary example we consider a band gap arising due to time-dependent distortions of the honeycomb lattice. By means of an exact, invertible, and transport-preserving mapping to a time-independent Hamiltonian, we show that the system exhibits Chern-insulating phases with quantized Hall conductivities $\pm e^2/h$. The chirality of the corresponding gapless edge modes is controllable by both the frequency of the driving and the manner in which sublattice symmetry is broken by the dynamical lattice modulations. We demonstrate that, while these phases are in the same topological sector as the Haldane model, they are nevertheless separated from the latter by a gap-closing transition unless an extra parameter is added to the Hamiltonian. Finally, we discuss a promising possible realization of this physics in photonic lattices.

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