Nonhermitian Topological Phases

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Topological stability of the edge states is investigated for non-Hermitian systems. We examine two classes of non-Hermitian Hamiltonians supporting real bulk eigenenergies in weak non-Hermiticity: SU(1,1) and SO(3,2) Hamiltonians. As an SU(1,1) Hamiltonian, the tight-binding model on the honeycomb lattice with imaginary on-site potentials is examined. Edge states with ReE=0 and their topological stability are discussed by the winding number and the index theorem, based on the pseudo-anti-Hermiticity of the system. As a higher symmetric generalization of SU(1,1) Hamiltonians, we also consider SO(3,2) models. We investigate non-Hermitian generalization of the Luttinger Hamiltonian on the square lattice, and that of the Kane-Mele model on the honeycomb lattice, respectively. Using the generalized Kramers theorem for the time-reversal operator Theta with $\Theta^2 = +1$, we introduce a time-reversal invariant Chern number from which topological stability of gapless edge modes is argued.