Topology by Dissipation: Majorana Fermions in One and Two Dimensions

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We discuss the emergence of topological phases in stationary states of engineered driven-dissipative dynamics.

To set the stage, first the basic setting of quantum state engineering via dissipation in many-body systems of atomic bosons and fermions is sketched. Then we focus on a quantum wire of spinless atomic fermions in an optical lattice coupled to a bath. The key feature of the dissipative dynamics described by a Lindblad master equation here is the existence of Majorana edge modes, representing a non-local decoherence free subspace. We highlight the characteristic many-body properties of such states, which exhibit phenomena without Hamiltonian counterpart -- especially in an extension of the concept to two dimensions. We also discuss possible preparation and detection schemes to reveal the Majorana physics.