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Witnessing Environment Induced Topological Phase Transitions via Quantum Monte Carlo and Cluster Perturbation Theory Studies

Many-body interactions play a crucial role in quantum topological systems, being able to impact or alter the topological classi- fications of non-interacting fermion systems. In open quantum systems, where interactions with the environment cause dissipation and decoherence of the fermionic dynamics, the absence of hermiticity in the subsystem Hamiltonian drastically reduces the sta- bility of the topological phases of the corresponding closed systems. Here we investigate the non-perturbative effects induced by the environment on the prototype Su-Schrieffer-Heeger chain coupled to local harmonic oscillator baths through either intra-cell or inter-cell transfer integrals. Despite the common view, this type of coupling, if suitably engineered, can even induce a transition to topological phases. By using a world-line Quantum Monte Carlo technique we determine the phase diagram of the model proving that the bimodality of the probability distribution of the polarization signals the emergence of the topological phase. We show that a qualitative description can be obtained in terms of an approach based on the Cluster Perturbation Theory providing, in particular, a non-Hermitian Hamiltonian for the fermionic subsystem and insights on the dissipative dynamics

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