Quantum Many Body Scars in the Presence of Density-Dependent Hopping

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Abstract

Quantum simulation of many body physics has been steadily improving, allowing for greater insight into strongly correlated systems as well as allowing for the engineering of new interactions, as well as probing quantum dynamics and nonequilibrium phenomena. In this work, we considered a bosonic chain under a density-difference-dependent Hamiltonian, where the hopping amplitude depends on the difference between the density on adjacent sites, focusing on the highly excited states of the model. This term can also be understood as an interaction with a sign that depends on the density fluctuations, acting either attractively or repulsively. This dual nature of the interaction allows the model to maintain a chiral symmetry, which we have previously demonstrated gives rise to emergent SSH-like physics. Considering this system at half-filling, we have found evidence for two types of quantum many body scars: localized edge modes and a charge density wave and have identified two unique mechanisms that stabilize these scars. The localized edge modes can be understood as a combination between the chiral symmetry and an effective single particle description which reveals "defect" states. On the other hand, the charge density wave scar results from destructive interference between the bare hopping and the correlated hopping.

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