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Thermal Stability of 2-Dimensional Topological Color Code

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Abstract

Thermal stability of the topological color code in presence of a thermal bath is studied. We study the Lindblad evolution of the observables in the weak coupling limit of the Born-Markov approximation. The auto-correlation functions of the observables are used as a figure of merit for the thermal stability. We show that all of the observables auto-correlation functions decay exponentially in time. By finding a lower bound of the decay rate, which is a constant independent of the system size, we show that the Topological Color Code is unstable against thermal fluctuations from the bath at finite temperature, even though it is stable at $T=0$ against local quantum perturbations.