Decoherence as a signature of an excited state quantum phase transition

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Abstract

We analyze the decoherence induced on a single qubit by the interaction with a two-level boson system with critical internal dynamics. We explore how the decoherence process is affected by the presence of quantum phase transitions in the environment. We conclude that the dynamics of the qubit changes dramatically when the environment passes through a continuous excited state quantum phase transition. If the system-environment coupling energy equals the energy at which the environment has a critical behavior, the decoherence induced on the qubit is maximal and the fidelity tends to zero with finite size scaling obeying a power-law.

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