

## Quantum Physics

# Probing a composite spin-boson environment

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We consider non-interacting multi-qubit systems as controllable probes of an environment of defects/impurities modelled as a composite spin-boson environment. The spin-boson environment consists of a small number of quantum-coherent two-level fluctuators (TLFs) damped by independent bosonic baths. A master equation of the Lindblad form is derived for the probe-plus-TLF system. We discuss how correlation measurements in the probe system encode information about the environment structure and could be exploited to efficiently discriminate between different experimental preparation techniques, with particular focus on the quantum correlations (entanglement) that build up in the probe as a result of the TLF-mediated interaction. We also investigate the harmful effects of the composite spin-boson environment on initially prepared entangled bipartite qubit states of the probe and on entangling gate operations. Our results offer insights in the area of quantum computation using superconducting devices, where defects/impurities are believed to be a major source of decoherence.

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