

Title: Global vs. Local Decoherence of Qubits *

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Abstract: Environmental entanglement of a small quantum system occurs extremely rapidly and is essentially impossible to reverse. Here we ask about the residual mutual coherence between two such small systems. Are non-local measures of coherence such as entanglement between them more susceptible to rapid decay than local measures? An instance of potential importance for solid state quantum computing arises if embedded qubit spins are exposed to both global and local noise at the same time. We obtain the 12 Kraus operators [1] relevant to this question, and with them show that phase-noisy channels affect local and non-local measures of system coherence differently. A consequence is that the time for entanglement decay can be much shorter than the time for complete local dephasing for two qubits.

[1] T. Yu and J.H. Eberly, submitted to Phys. Rev. B (2003)

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