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Decoherence by Correlated Noise and Quantum Error Correction[1] EDUARDO NOVAIS, HAROLD U. BARANGER, Duke University — We study the decoherence of a quantum computer in an environment which is inherently non-Markovian and spatially correlated. We first derive the non-unitary time evolution of the computer and environment in the presence of a stabilizer error correction code. Our results demonstrate that effects of long-range correlation can be systematically reduced by suitable changes in the error correction codes. The new element that we discuss is that the periodic measurements in the QEC method separate the environmental modes into high and low frequencies. This natural "new" scale can then be used to better engineer quantum codes. As an example of this general discussion, we study decoherence in a quantum memory protected by Steane's three qubit code. The memory interacts with a bosonic enviroment through the spin-boson Hamiltonian. We calculate explicitly the long-range correlations in this case and demonstrate that a simple change in Steane's code reduces their effect.

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