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Spin-bath autocorrelation functions directly from quantum theory[1] WAYNE WITZEL, Sandia National Laboratories, NM, KEVIN YOUNG, Sandia National Laboratories, CA, SANKAR DAS SARMA, University of Maryland, College Park — Cluster expansion techniques have enabled accurate modeling of the effects of a bath of local spins on solid state spin qubits with proven predictive power. These calculations are performed in the context of specific echo decay experiments (Hahn echo, CPMG, etc.). Classical noise, on the other hand, is described by a single autocorrelation function (or spectral density, equivalently) that is applicable to any control-specific experiment. Such a description is very useful in searching for optimal controls to produce high fidelity quantum logic gates using well-studied techniques. We demonstrate a cluster expansion method for directly computing autocorrelation functions as expectation values in the quantum spin-bath setting and show that it is a sufficient description of the noise effects for certain regimes, particularly in the high fidelity regime of interest. We use this approach to study the theoretical impact of using optimized pulse sequences tailored to individual qubits in enriched silicon.

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