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Linked cluster expansion of a qubit decoherence¹ SEMION SAIKIN, University of California, San Diego, WANG YAO, University of Texas, Austin, LU SHAM, University of California, San Diego — We present a theoretical approach to study evolution of a qubit affected by a coupling with a spin bath. The procedure based on a linked cluster decomposition of system and bath dynamics. Unlike previous studies the approach allows exact evaluation of terms of each perturbative order in the exponent contributing to qubit decoherence and phase fluctuations. The procedure has a simple diagrammatic representation. We have utilized the theory to evaluate decoherence of a localized electron spin subject to an interaction with a nuclear spin bath. The novel results we report on are effects of nuclear spin clusters on electrons spin decoherence beyond pair correlation models and also control for dissipation processes in a spin environment.

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Semion Saikin
University of California, San Diego

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