Abstract Submitted
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Reduced-Density-Matrix Description of Decoherence and Relaxation Processes for Electron-Spin Systems[1] VERNE JACOBS, Naval Research Laboratory — Electron-spin systems are investigated using a reduced-density-matrix description. Applications of interest include trapped atomic systems in optical lattices, semiconductor quantum dots, and vacancy defect centers in solids. Complimentary time-domain (equation-of-motion) and frequency-domain (resolvent-operator) formulations are self-consistently developed. The general non-perturbative and non-Markovian formulations provide a fundamental framework for systematic evaluations of corrections to the standard Born (lowest-order-perturbation) and Markov (short-memory-time) approximations. Particular attention is given to decoherence and relaxation processes, as well as spectral-line broadening phenomena, that are induced by interactions with photons, phonons, nuclear spins, and external electric and magnetic fields. These processes are treated either as coherent interactions or as environmental interactions. The environmental interactions are incorporated by means of the general expressions derived for the time-domain and frequency-domain Liouville-space self-energy operators, for which the tetradic-matrix elements are explicitly evaluated in the diagonal-resolvent, lowest-order, and Markov (short-memory time) approximations.

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