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Electron Spin Dynamics of Hyperfine Interaction in a Quantum Dot CHANNGXUE DENG, XUEDONG HU, University at Buffalo, SUNY, Buffalo, NY — We investigate spin dynamics of electrons in a quantum dot interacting with nuclei through the inhomogeneous hyperfine coupling. The problem has been studied previously using either perturbation theory (fails at zero nuclear spin polarization) or treating the system semi classically (Markovian approximation). In this paper we study the system systematically with a large N (effective number of nuclear spins in the dot) expansion technique which is valid at arbitrary nuclear polarization and external magnetic field. The coherent oscillations and the decoherence, represented by the poles and the branch cuts respectively, are treated in a unified way within this non-perturbative method. Our calculations reproduce previous results of highly polarized nuclear spin configuration. On the other hand we find some new features of the real time dynamics for the unpolarized nuclear spins which has not been obtained.

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