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Single-electron spin decoherence by nuclear spin bath: Linked-cluster expansion approach

Saikin S., Yao W., Sham L.

Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

We develop a theory for decoherence dynamics of a single-electron spin interacting with a nuclear spin bath. The approach yields a simple diagrammatic representation and analytical expressions of different nuclear spin excitation processes contributing to electron spin decoherence and dynamical phase fluctuations. It accounts for nuclear spin dynamics beyond the recently developed pair correlation models. As an illustration of the theory, we evaluated the coherence dynamics of a P donor electron spin in a Si crystal. © 2007 The American Physical Society.

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