

Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Many-body theory of spin bath dynamics for qubit decoherence¹

REN-BAO LIU, WEN YANG, The Chinese University of Hong Kong — We have developed a cluster correlation expansion (CCE) theory for the many-body dynamics of a finite-size spin bath in a time scale relevant to decoherence of a center spin or a qubit embedded in the bath [1]. In terms of the linked cluster expansion, a cluster correlation term is the infinite summation of all the linked diagrams with all the spins in the cluster flip-flopped. The lowest order of the cluster correlation corresponds to the pair-correlation approximation developed previously [2]. In the thermodynamics limit, the CCE reduces to the standard cluster expansion. The CCE is especially useful for studying multi-spin coherence in small spin baths such as NV centers in diamonds and molecular magnets, where the cluster expansion fails to converge to the exact solution.

[1] W. Yang and R. B. Liu, Phys. Rev. B **78**, 085315 (2008).

[2] W. Yao, R. B. Liu and L. J. Sham, Phys. Rev. B **74**, 195301 (2006).

¹This work was supported by Hong Kong RGC Project 401906.

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Date submitted: 01 Dec 2008

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