

Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Quantum theory of decoherence in solid-state spin quantum computing architectures¹ WAYNE WITZEL, SANKAR DAS SARMA, University of Maryland — Decoherence is the adversary of any proposed quantum computer. In order to overcome it, we must understand it. Nuclear induced spectral diffusion, a type of electron spin decoherence caused by interaction with a nuclear spin bath, is a predominant source of information loss for solid-state spin quantum computing architectures. All previous theories for this 50-year-old problem have used phenomenological, semi-classical models. This talk presents our cluster expansion method which provides the first fully microscopic and quantum mechanical solution to this problem. With our method it becomes possible to ascertain the effectiveness of pulse sequences designed to enhance spin coherence.

¹This work is supported by ARO-ARDA and LPS-NSA.

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Date submitted: 29 Nov 2005

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