Abstract Submitted
for the MAR08 Meeting of
The American Physical Society

Decoherence of coupled electron spins via nuclear spin dynamics in quantum dots[1] WEN YANG, REN-BAO LIU, Department of Physics, The Chinese University of Hong Kong, Shatin, N. T., Hong Kong, China — Decoherence of coupled electron spins due to electron-nuclear hyperfine interaction in double quantum dots is a major issue of solid-state quantum computation. Using an interacting nuclear spin bath model, we show theoretically that the exchange interaction between the two electron spins renormalizes the pair- flip excitation energy in the bath and modifies the non- Markovian bath dynamics, which in turn changes the electron singlet-triplet (S-T) decoherence arising from electron-nuclear entanglement. As the energy renormalization varies with the Overhauser field mismatch between the quantum dots, the S-T decoherence depends on the sampling of nuclear spin states from an ensemble, leading to the transition from super-exponential decoherence in single-sample dynamics to power-law decay under ensemble average,[1] in contrast with the sample-independent super-exponential decoherence of a single electron spin in one dot.

[1] W. Yang and R. B. Liu, arXiv:0707.2529v1.

[1]This work was supported by Hong Kong RGC Project 2160285.

Wen Yang
Department of Physics, The Chinese University of Hong Kong,
Shatin, N. T., Hong Kong, China

Date submitted: 02 Dec 2007 Electronic form version 1.4