

Abstract Submitted  
for the MAR13 Meeting of  
The American Physical Society

**Error in a spin-SWAP gate due to hyperfine interaction in a double quantum dot**<sup>1</sup> JO-TZU HUNG, Department of Physics, University at Buffalo, State University of New York, LUKASZ CYWIŃSKI, Institute of Physics, Polish Academy of Sciences, XUEDONG HU, Department of Physics, University at Buffalo, State University of New York — We study the SWAP gate for two exchange-coupled electron spins under the influence of hyperfine (hf) interaction in a double quantum dot. A gate error develops during such a gate because hf interaction causes dephasing between any pair of two-spin states. We find that this gate error is initial-state-dependent. For example, an initial state in the  $S_z = 0$  subspace suffers only from  $S - T_0$  dephasing, leading to smaller gate error than in the case of other initial states. We calculate the gate fidelity for typical initial states, and compare the resulting gate errors. We also analyze the effects of inhomogeneous broadening on the gate fidelity in the presence of a random Overhauser field.

<sup>1</sup>We acknowledge support from US ARO, DARPA QuEST, NSF PIF, and the Homing Programme of the Foundation for Polish Science.

Jo-Tzu Hung  
Department of Physics, University at Buffalo, State University of New York

Date submitted: 08 Nov 2012

Electronic form version 1.4