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Gate control of a quantum dot single-electron spin through Geometric Phases: Feynman Dis-entangling Method SANJAY PRABHAKAR, JAMES RAYNOLDS, College of Nano Scale Science and Engineering, State University of New York at Albany, AKIRA INOMATA, Physics Department, State University of New York at Albany — Among recent proposals for next-generation, non-charge-based logic is the notion that a single electron can be trapped and its spin can be manipulated by moving the quantum dot adiabatically in a closed loop (Berry effect) through the application of gate potentials. In this paper, we present numerical simulations and analytical expressions of such spins in single electron devices for a quantum dot. Using analytical and numerical techniques, we show that spin orbit coupling in III-V type semiconductor will enhance the transition probability of the electron spin over pure Rashba and or pure Dresselhaus cases. With the help of Feynman Dis-entangling technique of the non-abelean operator, we found the exact analytical expression for the propagator of an electron moving under the influence of three different cases: pure Rashba, pure Dresselhaus and equal strength of Rashba and Dresselhaus spin orbit coupling. For the most general cases where the solution of the propagator becomes non-trivial, we carry out the numerical simulations of such propagator.

Sanjay Prabhakar
College of Nano Scale Science and Engineering,
State University of New York at Albany

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