

Abstract Submitted
for the DAMOP12 Meeting of
The American Physical Society

Geometric quantum gates for an electron-spin qubit in a quantum dot VLADIMIR MALINOVSKY, SERGEY RUDIN, Army Research Laboratory, Adelphi, MD 20783 — A scheme to perform arbitrary unitary operations on a single electron-spin qubit in a quantum dot is proposed. The design is based on the geometrical phase acquired after a cyclic evolution by the qubit state. The scheme is utilizing ultrafast linearly-chirped pulses providing adiabatic excitation of the qubit states and the geometric phase is fully controlled by the relative phase between pulses. The analytic expression of the evolution operator for the electron spin in a quantum dot, which provides a clear geometrical interpretation of the qubit dynamics, is obtained. Using parameters of InGAN/GaN, GaN/AlN quantum dots we provide an estimate for the time scale of the qubit rotations and parameters of the external fields. Robustness of the proposed scheme against external noise is also discussed.

Vladimir Malinovsky
Army Research Laboratory, Adelphi, MD 20783

Date submitted: 27 Jan 2012

Electronic form version 1.4