

Abstract Submitted  
for the MAR13 Meeting of  
The American Physical Society

**Local control of single-electron spin using spin-orbit coupling<sup>1</sup>**

MIGUEL ANGEL RODRIGUEZ-MORENO, Centro de Investigaciones en Semiconductores-ICUAP, LILIA MEZA-MONTES, Instituto de Fisica BUAP, DAVID HERNANDEZ DE LA LUZ, Centro de Investigaciones en Semiconductores-ICUAP — It has been demonstrated that CNOT quantum gates combined with single qubit operations form a universal set for quantum computing. In spin-based quantum qubits both conditions can be achieved by using a double quantum dot with two electrons. This configuration also allows for the realization of a completely electrical control of the spins, provided that hyperfine and spin-orbit interactions exist in the system. In this work, we simulate numerically the dynamics of the spin of two electrons in a double quantum dot. We use a combination of finite differences, direct diagonalization and a time propagator approach in order to solve the time-dependent two-electron Schrödinger equation. The single qubit operation is simulated by bringing the system into a separated charge state and then applying a time-varying electric field locally to one of the dots. It is shown that the spin-orbit coupling induces Rabi oscillations and that the frequency and amplitude of these oscillations can be varied by changing the magnitudes of the electric and static magnetic fields. We also analyze the role of the direction of the static magnetic field; in particular, we determine the variation of the spin dynamics with respect to direction of an in-plane static magnetic field.

<sup>1</sup>Partially supported by Grant CB-2009-133516-Conacyt, Mexico.

Lilia Meza-Montes  
Instituto de Fisica BUAP

Date submitted: 12 Dec 2012

Electronic form version 1.4