Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Spin-orbit effects on the full dynamics of double quantum dot qubit states[1] ERNESTO COTA, Centro de Nanociencias y Nanotecnologia - UNAM, Ensenada, Mexico, JUAN E. ROLON, Department of Physics and Astronomy, Ohio University, Athens, OH 45701-2979 USA, GLORIA PLATERO, Instituto de Ciencia de Materiales de Madrid - CSIC, Cantoblanco 28049, Madrid, Spain, SERGIO E. ULLOA, Department of Physics and Astronomy, Ohio University, Athens, OH 45701-2979 USA — We study spin-obit interaction (SOI) and relaxation effects on the measurement of the extended singlet state return probability $P(S)$ in a double quantum dot (DQD) system with two electrons, in the presence of hyperfine interaction (HFI) and weak external magnetic fields. Using appropriate pulse cycles to change the detuning between the two quantum dots, we describe the full dynamical behavior of the system taking into account the complete set of states. We find that the mixing of the $m_s = 1$ (T_+) triplet with the (0,2) local singlet, induced by SOI via non-spin-conserving tunneling transitions, has an important effect on the measurement of $P(S)$, and a clear experimental signature. The numerical results are also analyzed in terms of a Feshbach projection to the effective low-energy dynamics, which explain the role of SOI on the relaxation and overall dynamics relevant in experiments. We also explore the case of the Landau-Zener-Stückelberg interferometry realized via voltage sweeps through the $S - T_+$anticrossing generated by HFI in the DQD energy spectrum [1]. We focus on studying the effects of SOI and relaxation on the interferometric properties of the system in this regime. [1] J.R. Petta, H. Lu and A.C. Gossard, Science 327, 669 (2010).

[1]Supported by NSF-PIRE, NSF-MWN/CIAM and PAPIIT-DGAPA-UNAM

Ernesto Cota
Centro de Nanociencias y Nanotecnologia - UNAM, Ensenada, Mexico

Date submitted: 12 Nov 2011 Electronic form version 1.4