Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Spin polarized current in a double quantum dot with time-dependent interdot tunneling[1] ERNESTO COTA, FRANCISCO MIRELES, FERNANDO ROJAS, CCMC-UNAM, SERGIO E. ULLOA, Ohio University — A bipolar spin filter has been proposed using a few-electron double quantum dot (DQD) in a 'hanging-dot' configuration [1], and tunable by controlling the molecular hybridization (interdot tunneling) between dots. The bipolar nature of the electron spin current arises from a singlet-triplet transition in the ground state of the two-electron DQD. The transition occurs due to the competition among Zeeman energy, exchange interaction and interdot coupling, favoring a lower (higher) energy for the triplet (singlet) configuration in the weak (large) interdot tunneling regime. In this work we use a density matrix equation to study the dynamical behavior of the DQD, by considering the adiabatic variation of the interdot tunneling in time. We report on the spin-polarized current through the DQD as a function of the relevant physical parameters. A bipolar spin filtering effect in the time domain is observed to arise on time scales smaller than the relevant coherent and spin relaxation times in typical QDs. Spin-orbit coupling is included in our approach but found to not significantly affect our results. [1] F. Mireles, E. Cota, F. Rojas and S.E. Ulloa, submitted.

[1]Work supported by DGAPA-UNAM project IN114403 and CONACYT project 43673, and the 21st Century Indiana Fund

Francisco Mireles
Centro de Ciencias de la Materia Condensada-UNAM

Date submitted: 07 Dec 2005 Electronic form version 1.4