Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Indirect spin-spin interaction mediated by cavity photons GUILLERMO QUINTEIRO, Univ de Buenos Aires — I theoretically investigate the spin-spin indirect interaction mediated by photons, and compare the results with previous work on the indirect interaction mediated by excitons and/or polaritons in bulk semiconductor and two-dimensional cavities. The systems consist of a cavity, either 0D or 2D, containing two QDs, each one coupled to a donor impurity. The neutral QDs are excited by a cavity photon, and the resulting exciton interacts with the impurity via exchange between the electron in the donor and the electron in the exciton. In the case of a 2D cavity, where the system is optically excited by an off-resonance monochromatic laser field, I deduce an effective Ising Hamiltonian for the spin-spin interaction using a perturbation theory approach. In the case of a 0D cavity, the exact eigenvalues and eigenvectors of the complete Hamiltonian involving the donors, excitons and cavity photons were determined by numerical diagonalization. The eigenvectors and energies were then used to calculate the spin-spin correlation and an effective donor-donor Hamiltonian was deduced. The numerical calculations performed for all admissible values of the physical constants revealed that the in-plane or xy correlation is zero; thus, I concluded that the effective interaction is of the Ising type. In addition, I found that the largest effective coupling J_{eff} corresponds to a situation where the excitons and the cavity photon are completely mixed, forming a polariton.

Guillermo Quinteiro
Univ de Buenos Aires

Date submitted: 29 Oct 2010 Electronic form version 1.4