Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Hyperfine interaction in silicon quantum dots[1] BELITA KOILLER, Instituto de Fisica, UFRJ, LUCY V.C. ASSALI, HELENA M. PETRILLI, Instituto de Fisica, USP, Brazil, RODRIGO B. CAPAZ, Instituto de Fisica, UFRJ, XUEDONG HU, Department of Physics, University at Buffalo, SUNY, SANKAR DAS SARMA , Condensed Matter Theory Center, Department of Physics, UMD — Spins in semiconductor nanostructures are promising qubit candidates for solid state quantum computing. For Si:P systems, the main factor that determines quantum coherence of donor electron spins is their hyperfine (HF) interactions with the host ^{29}Si nuclei. The success of experimental studies of spin dynamics in gated semiconductors (in particular GaAs quantum dots - QDs) motivated several groups to perform similar experiments in gated QDs in Si. Gated QDs are more flexible and tunable than the Si:P system. We report results from a first- principles all-electron calculation of the HF interaction strength (both isotropic and anisotropic) for a single conduction electron in Si, which as far as we know has not been previously reported in the literature. We compare our theoretical values with previous experimental measurements to ascertain the reliability of our calculations. We discuss implications of our results on QD-confined electron spin decoherence and manipulation.

[1]Support in Brazil from CNPq, FAPERJ and FAPESP, and in the US from LPS, NSA/LPS through ARO, and DARPA QuEST

Belita Koiller
Instituto de Fisica, UFRJ

Date submitted: 20 Nov 2009 Electronic form version 1.4