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Control of exchange coupling in Si double quantum dots¹ DIMITRIE CULCER, L. CYWINSKI, QIUZI LI, SANKAR DAS SARMA, Condensed Matter Theory Center, Department of Physics, University of Maryland, College Park MD 20742 — We determine the exchange coupling in a Si double quantum dot in the Heitler-London approximation. Qubit manipulation in bulk Si is hindered by the sixfold valley degeneracy of conduction band electrons which causes the exchange interaction between qubits to oscillate as a function of their separation. We demonstrate that in quantum dots these oscillations are suppressed by quantum confinement. We determine the dependence of the exchange coupling on the barrier potential between the dots and examine the role of charge fluctuations. Our results suggest that together with long Si spin lifetimes Si quantum dots could lead to improved control of spin qubits. Within the Heitler-London approximation the work presented is completely general and the results are valid for any ground state.

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