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Charge fluctuation induced dephasing of exchange coupled spin qubits[1] XUEDONG HU, University at Buffalo, SUNY, S. DAS SARMA, University of Maryland — Exchange coupled *spin* qubits in semiconductor nanostructures are shown to be vulnerable to dephasing caused by *charge noise* invariably present in the semiconductor environment. This decoherence of exchange gate by environmental charge fluctuations arises from the fundamental Coulombic nature of the Heisenberg coupling, and presents a serious challenge to the scalability of the widely studied exchange gate solid state spin quantum computer architectures. We explore the properties of the resulting exchange gate errors, and estimate dephasing times for coupled spin qubits in a wide range (from 1 nanosecond up to more than 1 microsecond) depending on the exchange coupling strength and its sensitivity to charge fluctuations in a particular nanostructure.

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