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Spin Qubit Relaxation in a Moving Quantum Dot[1] PEIHAO HUANG, XUEDONG HU, State Univ of NY - Buffalo — Long-range quantum communication for spin qubits is a significant open problem in the scale-up of spin qubit architectures. Among the many spin information transfer proposals, directly moving the electrons themselves is attractive because of its conceptual simplicity and its similarity to the conventional charge-coupled devices. Here we focus on electron spin decoherence when the quantum dot is in motion. Specifically, we study a spin decoherence mechanism for a moving but confined electron due to the spin-orbit interaction and an environmental random electric potential. We find that at the lowest order, the magnetic fluctuations experienced by the spin have only components transverse to the total magnetic field, so that the motion induced spin decoherence is a pure longitudinal relaxation channel. Our calculated spin relaxation time ranges from as fast as sub μs in GaAs to above ms in Si. Our results also clearly indicates how to reduce the decoherence effects of electron motion.

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