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Spin relaxation in a nanowire quantum dot due to electrical noises[1] JO-TZU HUNG, XUEDONG HU, Department of Physics, University at Buffalo, State University of New York — Semiconductor nanowire with strong spin-orbit couplings makes fast electrical coherent control feasible for spin qubits. One example is the spin-orbit qubit [1], confined by nanowire based quantum dots made from InAs or InSb. Because of the strong spin-orbit coupling, such a qubit is naturally sensitive to electrical noises. We theoretically investigate the influence of electrical noise on spin-orbit qubit by considering fluctuations from the gates and/or defects. We start from a three-dimensional Hamiltonian, and consider spin-orbit couplings for nanowires with zincblende structure grown along [111] and those with wurtzite structure grown along [001], respectively. We then analyze spin relaxation as we vary the parameters for the system, such as the magnitude and direction of the applied magnetic field, nanowire thickness, and the quantum dot confinement. [1] Nadj-Perge et al., Nature 468, 1084 (2010).

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