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Electric readout and storage concepts for electron and nuclear spin states in silicon

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A variety of concepts utilizing spins in semiconductors for information storage and processing have been proposed in recent years. One of these concepts [1] uses the phosphorous nucleus in crystalline silicon as a quantum bit, an approach which combines longest known spin coherence times and, therefore, spin storage times, with already existing, well developed and highly reliable, crystalline silicon nano-technology. Our research is focused on implementations of electric readout devices for electron- and nuclear-spins in silicon. I will review different experiments which show how donor electrons [2-4] and nuclear [5] spins of phosphorous atoms in crystalline silicon can be used as a electrically readable spin memories with long storage times for classical and quantum information and how nuclear spin qubits can be initialized [6].

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