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**Quantum computing and cavity QED with spins**

This talk covers spin-based quantum information processing from a theoretical perspective, starting from the fundamental physical principles and including some of the latest achievements. Recently, electric spin control using synthetic spin-orbit coupling due to magnetic field gradients in combination with the exchange coupling has allowed for electrically controlled one- and two-qubit gates for spins in silicon quantum dots. An alternative approach to all-electric control of spin qubits consists in the use of multi-spin qubits consisting of more than one electron, such as the singlet-triplet, exchange-only, resonant-exchange qubits, as well as quadrupolar qubits. The development of superconducting coplanar waveguide resonators has provided new opportunities for coupling spin qubits over long distances which have come into the reach of experimental feasibility with the recent achievement of the strong-coupling regime in spin-cavity quantum electrodynamics (QED).