Spin Qubits in Semiconductors for Scalable Quantum Computers

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Semiconductor spin qubits offer a unique opportunity for scalable quantum computation by leveraging classical transistor technology [1]. This has triggered a worldwide effort to develop spin qubits, in particular, in Si and Ge based quantum dots, both for electrons and for holes [2-5]. Due to strong spin orbit interaction, hole spin qubits benefit from ultrafast all-electrical qubit control and sweet spots to counteract charge and nuclear spin noise . In this talk I will present an overview of the state-of-the art in the field and focus, in particular, on recent developments on hole spin physics in Ge and Si nanowires, Si FinFETs, and Ge heterostructures [6-15], as well as strategies for maximizing valley splitting crucial for scalability of electron spin qubits in Si [16].

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