

Quantum computing with silicon and germanium

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Semiconductor quantum dots constitute a promising platform for quantum computation. Two decades after the seminal proposals by Loss and DiVincenzo, impressive results have been obtained, including the initialization, readout, and coherent control of single electron spins. Silicon has become the leading material as it can be isotopically purified, thereby removing a nuclear spin bath, such that qubits can be defined with extremely long coherence times.

I will present our latest efforts on silicon quantum computing. These include operation at elevated temperatures for hot-qubit operation, enabling to integrate classical electronics on the same chip for scalability and superior control. Moving forward, I will discuss our vision to increase the number of qubits toward that is needed for practical quantum information.

I will also present our parallel efforts on germanium. Starting from high-mobility quantum wells, we fabricate quantum dot and induce superconductivity for the creation of novel quantum devices. We find remarkably low charge noise, while we observe ballistic gate-tunable supercurrents that extend over micrometers.

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