

Spin-photon quantum computing

Quantum computing based on color center and nuclear spins in diamond

Spin qubit registers, which are realized via color centers and nuclear spins, can be connected within a photonic network to form a scalable quantum processor. Over the next five years, the goal is to demonstrate the operation of a universal quantum computer.

Together with renowned partners from research and industry, Fraunhofer IAF is pursuing the realization of a diamond-based spin-photon quantum computer in the joint projects QC-4-BW and Spinning.

Key features of a first generation demonstrator:

- Spin-register hosting an electron spin in an ensemble of about 5 nuclear spins each
- Addressability of individual qubits and quantum operations with several qubits in the register via radio-frequency and microwave pulses

Key features of a second generation demonstrator:

- Global register consisting of spin registers hosting an electron spin in an ensemble of about 5 nuclear spins each
- Coupling of spin-registers via optical network
- Qubit error correction algorithms implemented in the spin-registers and execution of quantum operations on error-tolerant coded quantum information

The quantum processor being developed in the project Spinning is capable of operating with low cooling requirements.
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