Diamond quantum networks for distributed quantum computation

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Quantum networks provide a promising way to realize large-scale quantum computations and simulations. Such networks consist of nodes that contain multiple qubits to store and process quantum states, and that are connected together by distributing entangled states through optical links using photons. Crucially, imperfections and errors can be overcome by distributing logical qubits, computations and error correction over the network [1]. This approach is scalable to large sizes by connecting many independent modules, thus avoiding the challenges of a single large structure of ever increasing complexity.

The nitrogen vacancy (NV) center in diamond is a promising candidate to realize such quantum networks, as it combines optical entanglement links [2] with long-lived multi-qubit nodes that can store and process quantum information [3-5]. In this talk I will discuss the recent progress of my group towards quantum networks for distributed quantum computations and argue that we are getting close to the point where imperfections can be overcome using quantum error correction so that the quantum network becomes increasingly stable as it is made larger and larger.

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