Experiments on an entanglement-based quantum network in the lab

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Quantum networks promise the ability to distribute quantum-entangled states over large distances for the purposes of quantum communication, distributed and blind quantum computation, or quantum sensing. Recently, we have realized the first multi-node quantum network in the lab, combining remote quantum photonic links with small quantum processors containing a diamond NV centre communication qubit and a carbon-13 memory qubit[1]. This network can serve as a testbed for control stack development and for exploring quantum network protocols. As an example, quantum teleportation between two non-neighbouring stationary nodes was recently demonstrated[2].

In this talk, we will report on the exploration of more network protocols using NV centres in diamond that are important for scaling quantum networks. We will discuss some of the underlying physical layer and control layer challenges, and our approach to solving these. This work will build up on the detailed study on factors that affect both the rate and fidelity of the quantum-entangled state between two distant qubits[3].

References

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