Absorption-based Quantum Communication with NV centres

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We propose a scheme which makes use of the Bell-like structure of a single NV- centre's A2 excited state to implement a direct entanglement-swap upon a heralded absorption. The limited quantum efficiency of a single absorption process (at most 25%) could be improved by placing the NV inside a micro cavity, to boost interaction with the photon, plus a loop structure which routes the leaked photon back into the cavity after flipping its phase, polarisation or both. Throughout this process, the NV is monitored via a QND measurement heralding photon absorption and thus successful teleportation of the entangled link to the remote qubits. Given low losses and high per-pass absorption probability, this scheme ensures that eventually the total success probability approaches unity, while the fidelity of the established links is also high. With the long electron spin coherence times possible at low temperatures, this component could be useful as node in a memory-based quantum repeater.

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