NV Centers in Quantum Information Technology: De-Coherence Protection & Teleportation

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Nitrogen-Vacancy (NV) defects in diamond have promising properties for applications in quantum information technology: In a static magnetic field, they contain two well-defined qubits in the form of a nuclear and an electron spin which are coupled through hyperfine interaction. In addition, there exist well-established techniques to initialize, manipulate, and read out those qubits. Future quantum devices will likely need to utilize the advantages of different types of physical qubits, however coupling qubits with vastly different decoherence rates has remained an elusive task until recently. A robust technique for coping with decoherence even during 2-qubit gate operations will be discussed, and the results of using such techniques to perform gate operations between electronic and nuclear spins states in an NV center will be presented. Methods to entangle separated NV centers via photons and how these systems can be used for quantum teleportation will also be discussed.