

Precision quantum state preparation of interacting spin systems

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Precision control of spins in diamond is the basis for their quantum application. As an example interacting defect center spins in diamond require high fidelity control of spin transition of individual defects in a dense spectral setting. Especially for defects with large mutual distances, i.e. weak coupling this can be a significant challenge. With optimal control, entanglement fidelities can reach up to 0.8. Similarly, efficient swap to nuclear spins and even high fidelity nuclear spin entanglement in the register can be generated. A further important step towards scaling of spin quantum registers is error correction. A 3 qubit error correction code, optimized by optimal control, has been implemented capable of correcting phase and bit flip errors. Application of optimized spin control in magnetic field imaging will be discussed also.