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**Double quantum coherence control in NV- centers in Diamond at small fields** OSAMA MOUSSA, Institute for Quantum Computing and Dept. of Physics, University of Waterloo, IAN HINCKS, Institute for Quantum Computing and Dept. of Applied Math, University of Waterloo, DAVID G. CORY, Institute for Quantum Computing and Dept. of Chemistry, University of Waterloo — The Nitrogen-Vacancy (NV) color center in diamond is a model quantum system with long coherence time, and the ability to optically initialize and read-out single centers. This makes it attractive for applications in quantum information processing, magnetometry, and magnetic imaging. The ground state of this localized defect is a triplet of magnetic states (ms = 0, ±1), where the ms = 0 state is separated from the ms = ±1 states at zero-field, and in the presence of a magnetic field, the ms = ±1 states are further split due to the Zeeman interaction. Towards the goal of high-fidelity coherent control of the full qutrit space, we study the dynamics of double quantum coherence (DQC) (ms=+1 ↔ ms=-1) in the regime where the Rabi drive is comparable to the Zeeman energy. We generate the DQC with high purity, selecting only the signal from the electronic transitions conditioned on the 14N nuclear spin being in the mn=0 state; we measure the coherence time of the DQC, and extend that coherence time using multiple-pulse sequences.

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