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Preserving Coherence in Rydberg Quantum Bits. RUSSELL S. MINNS, MARY R. KUTTERUF, MELISSA A. COMISSO, HUSSAIN ZAIDI, LUNG KO, ROBERT R. JONES, University of Virginia — Pulsed electric fields are used to create and manipulate qubits, made of the *np* Rydberg states of Li. The coherence time of the qubits is extended by three separate decoherence suppression schemes. One is based on a decoherence free sub-space (DFS) where the qubit is stored in a basis which is unaffected by its surrounding environment, and two are based on dynamic decoupling (DD) schemes. The SO interaction creates an approximate DFS where the qubit remains unaffected by small stray magnetic and electric fields. Despite this predicted stability, appreciable decoherence is observed within $\sim$10 μs, more active control is therefore required to extend the coherence time beyond this limit. The first DD scheme utilizes fast rising and falling electric field pulses to rapidly toggle between states where the SO coupling is on or off. This toggling is used to repeatedly flip the state vector of the system canceling out environmental interactions. The second scheme utilizes resonant RF pulses to continuously flip the state via Rabi flopping. Both DD schemes maintained coherence for times comparable to the spontaneous lifetime of the system.

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