Abstract Submitted
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Progress toward a protected subspace qubit in $^{138}Ba^{+}$ ions[1] MARTIN LICHTMAN, KSENIA SOSNOVA, ALLISON CARTER, SOPHIA SCARANO, CLAYTON CROCKER, CHRISTOPHER MONROE, Joint Quantum Institute and University of Maryland — The commonly used $^{138}Ba^{+}$ ion has zero nuclear spin and hence no magnetically insensitive Zeeman states. Following the proposal of Aharon, Drewsen, and Retzker, PRL 111, 230507 (2013), we seek to create states that have effective zero magnetic moment by creating superpositions of Zeeman levels in the $5D_{3/2}$ manifold. These synthetic qubit states are the dark eigenstates of the Hamiltonian in the presence of a driving field that creates a protected subspace. We report the creation of effective zero magnetic moment states using both STIRAP and Raman processes, including a novel detection scheme to verify the population distribution in the D manifold, and coherent flopping between these synthetic qubit states. The internal phase of the superposition states is verified through the flopping behavior as compared to simulations. An increase in coherence time in the absence of magnetic field stabilization is shown compared to $6S_{1/2}$ and $5D_{3/2}$ Zeeman qubits.

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