Abstract Submitted
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^{133}Ba^{+}: A radioactive trapped ion qubit[1] JUSTIN E. CHRISTENSEN, DAVID HUCUL, ERIC R. HUDSON, WESLEY C. CAMPBELL, Univ of California - Los Angeles — $^{133}Ba^{+}$ has been identified as an attractive trapped ion qubit due to its unique combination of spin-1/2 nucleus, visible-wavelength electronic transitions, and the longest $^{2}D_{5/2}$ lifetime of any alkaline-earth-like atomic ion. This nearly ideal system hosts hyperfine and optical qubit clock-states (long coherence times), enables fast high fidelity state preparation, and allows high fidelity readout via state selective electron shelving or direct optical qubit manipulation. Due to the 10.5yr half-life and unknown spectroscopic features required for laser cooling and qubit manipulations, $^{133}Ba^{+}$ had not been previously used as a host for quantum information. By using efficient loading and in-situ laser heating for isotopic purification, we can trap and laser cool a single $^{133}Ba^{+}$. We present recent work with $^{133}Ba^{+}$, including hyperfine qubit manipulations, the first demonstration of state selective electron shelving in $^{133}Ba^{+}$, and new spectroscopic measurements of the $^{2}P_{3/2}$ states. These measurements, along with continued efforts, will allow this optimal trapped ion qubit to be implemented across a wide range of current and future quantum information experiments.

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