

Abstract Submitted
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Robust quantum memory using magnetic-field-independent atomic qubits¹ C. LANGER, R. OZERI, J. D. JOST, B. DEMARCO², A. BENKISH³, B. BLAKESTAD, J. BRITTON, J. CHIAVERINI, D. B. HUME, W. M. ITANO, D. LEIBFRIED, R. REICHLER, T. ROSENBLAND, P. SCHMIDT, D. J. WINELAND — Scalable quantum information processing requires physical systems capable of reliably storing coherent superpositions for times over which quantum error correction can be implemented. We experimentally demonstrate a robust quantum memory using a magnetic-field-independent hyperfine transition in $^9\text{Be}^+$ atomic ion qubits at a field $B = 0.01194$ T. Qubit superpositions are created and analyzed with two-photon stimulated-Raman transitions. We observe the single physical qubit memory coherence time to be greater than 10 seconds, an improvement of approximately five orders of magnitude from previous experiments. The probability of memory error for this qubit during the measurement period (the longest timescale in our system) is approximately 1.4×10^{-5} which is below fault-tolerance threshold for common quantum error correcting codes.

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