Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Robust quantum memory using magnetic-field-independent atomic qubits[1] C. LANGER, R. OZERI, J. D. JOST, B. DEMARCO[2], A. BEN-KISH[3], B. BLAKESTAD, J. BRITTON, J. CHIAVERINI, D. B. HUME, W. M. ITANO, D. LEIBFRIED, R. REICHLE, T. ROSENBAND, 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 $^{9}Be^{+}$ 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.

[1]supported by DTO/NSA and NIST
[2]present address: University of Illinois, Urbana
[3]present address: Technion, Haifa, Israel

Chris Langer
NIST Boulder

Date submitted: 30 Nov 2005

Electronic form version 1.4