Ytterbium Ion Qubits for Quantum Information Processing

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We present trapped ytterbium ions as quantum bits for quantum information processing. The viability of this atomic ion as a qubit is demonstrated through high-fidelity state initialization and detection of the first-order magnetic field-insensitive hyperfine "clock" states, with a measured coherence time of at least 2.5 seconds. The simple atomic structure, large fine and hyperfine splittings, and transition wavelengths that facilitate the use of optical fibers, may allow for the implementation of a variety of quantum information processing schemes. In addition, we present improved measurements of the $^2P_{1/2}$ excited state lifetime and branching ratio into $^2D_{3/2}$.

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