

Abstract Submitted
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Implementation of Grover's search algorithm using entangled 'clock state' qubits¹ KATHY-ANNE BRICKMAN, MARK ACTON, LOUIS DESLAURIERS, PAUL HALJAN, PATRICIA LEE, CHRISTOPHER MONROE, FOCUS Center and the Department of Physics, University of Michigan — We experimentally demonstrate Grover's search algorithm over a space of $N=4$ elements with $n=2$ trapped $^{111}\text{Cd}^+$ ion qubits. One of the four states is marked, and with a single query it is recovered on average with a 60% probability. This exceeds the performance of any possible classical search, which can only succeed with 50% probability following a single query. The algorithm consists of two Molmer-Sorensen entangling gates paired with several single-qubit rotations and near-perfect qubit measurements. The Molmer-Sorensen gate has the unique advantage that it can entangle magnetic field insensitive 'clock-state' qubits and hence can be relatively insensitive to an important source of noise in trapped ion quantum gates.

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