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Rapid, Site-Selective Loading of a Scalable Array of Trapped Ions
COLIN BRUZEWICZ, ROBERT MCCONNELL, JOHN CHIAVERINI, JEREMY SAGE, MIT Lincoln Laboratory — Rapid trap reloading is a requirement for any scalable quantum information processor based on trapped-ion qubits. Even cryogenic systems with trap lifetimes in excess of 10 hours will require loading rates of approximately 100 s^{-1} to maintain arrays of millions of ions. Further, the reloading process should not introduce unacceptable levels of decoherence into other ions within the array. Here, we demonstrate rapid, site-selective, random-access loading of a 2x2 array of trapped ions that satisfies the major criteria for scalable quantum processing. This scheme uses a continuous flux of pre-cooled strontium atoms and a pair of orthogonal photo-ionization lasers to load surface-electrode point Paul traps at average rates greater than 400 s^{-1}. Additionally, we have conducted a series of Ramsey experiments to measure the effects of loading on the coherence of nearby trapped ions. C. D. Bruzewicz, R. McConnell, J. Chiaverini, and J. M. Sage, arXiv:1511.03293 (2015).

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