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Recent progress toward trapping, cooling, and imaging bosonic and fermionic Strontium atoms in optical tweezer arrays for quantum computing MICKEY MCDONALD, REMY NOTERMANS, STANIMIR KONDOV, KRISH KOTRU, BRIAN LESTER, ALEXANDER PAPAGEORGE, JONATHAN KING, ROBIN COXE, PRASAHNT SIVARAJAH, PETER BATTALIGNO, COLM RYAN, BENJAMIN BLOOM, Atom Computing, Inc., 918 Parker St, Suite A-13, Berkeley, CA 94710 — Neutral atoms trapped in focused light arrays have emerged as a leading contender to serve as a high-fidelity, scalable platform for quantum computing, as they can be individually interrogated with high precision using focused lasers; entangled via Rydberg interaction; and routinely trapped in the hundreds to thousands using optical lattices or tweezer arrays. Alkaline earth atoms in particular benefit from a complex level structure which allows for rapid doppler cooling to microkelvin temperatures, and possess long-lived metastable states which can be used for shelving. Prior work on trapping strontium in optical tweezers has focused on the bosonic isotope ^{88}Sr, whose zero-spin nucleus leads to simplified cooling schemes, but which allows for coherent transitions only in the optical regime. The complex nuclear structure of ^{87}Sr, however, opens up additional degrees of freedom which can be explored for quantum information processing. We discuss our recent progress toward trapping, cooling, and imaging both isotopes in reconfigurable arrays of optical tweezers, and discuss the path toward large numbers of qubits prepared and read out with the high fidelities necessary for implementing realistic QC algorithms.

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