Abstract Submitted
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Towards simulating many-body quantum dynamics with strontium atoms in optical tweezers. ALEXANDRE COOPER, JACOB COVEY, IVAYLO MADJAROV, BRIAN TIMAR, EMILY QIU, ALEXANDER BAUMGRTNER, MANUEL ENDRES, Caltech — Ultracold atoms in optical tweezers provide a versatile platform for simulating interacting many-body quantum systems. The ability to assemble single atoms in various spatial configurations, selectively address and control their quantum states, and introduce long-range interactions between them enables studying complex Hamiltonians that are otherwise difficult to access. We report on progress towards creating defect-free arrays of strontium atoms in optical tweezers with tunable Rydberg interactions. Strontium has narrow optical transitions and magic wavelengths, which enable robust cooling, trapping, and coherent manipulation of single atoms. We explore strategies for imaging and cooling atoms in optical tweezers, as well as scaling to larger arrays. We further explore approaches to engineering long-range interactions between strontium atoms via Rydberg states. Our work offers promising research avenues for studying non-equilibrium dynamics of disordered systems, realizing novel states of matter, and simulating spin models with tunable parameters.

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