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Generating spin-entanglement between two spatially separated neutral atoms in optical tweezers BRIAN J. LESTER, Yale University, MARK O. BROWN, YIHENG LIN, RANDALL J. BALL, JILA, University of Colorado, ADAM M. KAUFMAN, Harvard University, LEONID ISAEV, MICHAEL L. WALL, ANA MARIA REY, CINDY A. REGAL, JILA, University of Colorado — The ability to fully control individual neutral atoms trapped in optical tweezers has provided exciting possibilities for encoding and propagating quantum information in small arrays of traps. In these systems, the quantum statistics of the particles can dramatically affect the particle dynamics and lead to coupling between the spin and motional degrees of freedom. For example, we have observed the generation of spin-entanglement between two ^{87}Rb atoms undergoing spin-exchange due to an on-site contact interaction. Additionally, via postselection on the resulting spatial configuration, we show that noninteracting atoms can be probabilistically spin-entangled during tunneling of the atoms between the ground states of two optical tweezers. In this talk, I will detail our use of the optical tweezer platform to prepare arrays of indistinguishable atoms, imprint a desired initial spin configuration, and then take advantage of the quantum statistics of bosonic particles to generate and verify spin-entanglement between two ^{87}Rb atoms.

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