HQOC

Harvard Quantum Optics Center

Monday, February 2, 10:00 am

Jefferson 256

Adam Kaufman

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"Interfering and Entangling Single Neutral Atoms"

Optical tweezers have become a powerful and versatile tool for quantum control of single neutral atoms. I will present two experiments that demonstrate these capabilities, which rely on the ability to control all spin, motional and spatial degrees of freedom of two single atoms. In the first experiment, we interfere two atoms on an atomic beamsplitter formed by a tunnel-coupled double-well potential. The interference is directly analogous to that observed with photons in the original Hong-Ou-Mandel experiment, and demonstrates the indistinguishability and quantum state purity reached for the independently prepared atoms. The second experiment focuses on the generation of non-local entanglement via local interactions. We utilize a spin-exchange effect mediated by the contact interaction between the atoms to create entanglement between motional and spin degrees of freedom, which we then convert to entanglement between spatial and spin degrees of freedom by separating the atoms and verifying the persistence of their two-particle coherence. I will discuss the implication of these experiments for various quantum systems, ranging from nano-photonic interfaces to entanglement entropy measurements in many-body systems.