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Host: Jonathan Home and Andreas Wallraff

Spin-motional coupling in assembled quantum gases

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The use of optical tweezers to trap and control single neutral atoms has become a promising method to assemble and study out-of-equilibrium quantum many-body systems. In such systems, the quantum statistics of the particles dramatically affect the particle dynamics and lead to coupling between the spin and motional degrees of freedom. For example, we have observed the dynamical generation of spin-entanglement between two 87Rb atoms via the spin-exchange interaction and have verified that this entanglement is maintained after the spatial separation of the atoms. In this talk, I will discuss our use of the optical tweezer platform to prepare arrays of indistinguishable atoms, imprint a desired initial spin configuration, and then place the atoms in the same optical potential. Additionally, I will discuss our ongoing work to extend these capabilities to study a larger number of atoms, where the spin-motional coupling can lead to interesting and complex dynamics.