Abstract Submitted
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Ultracold polar molecules as a quantum simulator[1] STEVEN MOSES, BO YAN, BRYCE GADWAY, JACOB COVEY, KADEN HAZZARD, ANA MARIA REY, DEBORAH JIN, JUN YE, JILA, NIST, and University of Colorado, Boulder — One of the main goals of quantum simulation is to experimentally realize tunable quantum systems as a way to gain insight into strongly correlated many-body phenomena. We have taken the first steps toward this goal in our system of ultracold polar KRb molecules. By encoding spin in rotational states, we have observed spin exchanges of molecules confined in a deep three-dimensional optical lattice. The interactions manifest as a density dependent decay of the spin coherence of the system. In addition, the spin contrast oscillates, with frequency components consistent with the dipolar interaction energies. We vary the interaction strength by using two different pairs of rotational states, and find the decay and oscillations to be roughly twice as fast in the case of stronger interactions. Our experiments are developing in tandem with new theory techniques to describe far-from-equilibrium, long-range interacting systems. In this way, our experiments have led to the development of improved theoretical tools which can be applied to other systems and motivate further experiments on strongly correlated quantum systems. For example, higher lattice fillings in our experiment could enable the study of transport of excitations in an out-of-equilibrium, long-range interacting system.

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