Abstract Submitted
for the 4CF17 Meeting of
The American Physical Society

A Next-Generation Ultracold KRb Apparatus WILLIAM TOBIAS, LUIGI DE MARCO, GIACOMO VALTOLINA, KYLE MATSUDA, JACOB COVEY, JUN YE, University of Colorado/JILA — Ultracold polar molecules interact via long-range, anisotropic dipole-dipole potentials, allowing the realization of novel many-body quantum phases. Proposed areas of study for polar molecule lattice systems include spin-orbit coupling, topological phases, and exotic superfluidity. We present progress towards a next-generation KRb apparatus featuring improved electric field control and imaging. The apparatus contains in-vacuum electrodes to generate large (30 kV/cm) homogeneous fields for tuning dipolar interactions, electric field gradients for site-selective imaging, and AC electric fields for manipulating molecular rotational states. A high-numerical aperture lens system will provide addressing and imaging of KRb molecules in an optical lattice with resolution approaching the lattice spacing. Future experiments will include evaporation of KRb molecules to quantum degeneracy, preparation of low-entropy optical lattice samples, and spin-resolved microscopy of phases of dipolar spin Hamiltonians.

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Date submitted: 20 Sep 2017 Electronic form version 1.4