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A new apparatus for enhanced optical and electric control of ultracold KRb molecules GIACOMO VALTOLINA, JACOB COVEY, LUIGI DE MARCO, KYLE MATSUDA, WILLIAM TOBIAS, JUN YE, JILA, National Institute of Standards and Technology and Department of Physics, University of Colorado, Boulder, CO 80309, USA — Ultracold molecules represent an ideal platform for studying many-body physics with long-range dipolar interactions. The field of ultracold polar molecules has recently made enormous progress and many different bi-alkali molecules have been produced in their ground state. Recently, dipolar spin-exchange interactions and many-body dynamics have been observed with Fermionic KRb molecules in an optical lattice, and low-entropy samples in a lattice have been realized. However, the ability to apply large electric fields to polarize the molecules has been limited to several kV/cm. Additionally, high resolution in situ has been lacking for polar molecules despite the enormous progress in the quantum gas field. We present a new apparatus for producing Fermionic KRb molecules where stable, homogeneous electric fields in the range of 30 kV/cm are expected, while also accomodating arbitrary gradients in two dimensions. This apparatus is designed for high resolution addressing and detection, and imaging resolutions well below 1 micron are expected. We present details on this apparatus and its construction, and describe the procedure used to produce ultracold gases of atoms and molecules. Further work will lead to high resolution detection of strongly dipolar quantum systems.

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