Spin-resolved microscopy of Ultracold RbCs molecules.

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An important advance in quantum simulation of many-body systems with ultracold atoms has been the development of quantum gas microscopes [1], with single particle detection and manipulation allowing for investigation of the microscopic properties of atoms in optical lattices. Applying these techniques to ultracold molecules allows for the study of a wider variety of models, including anisotropic Hamiltonians and many-body phases due to the molecules' rich internal structure and the long-range dipolar interactions [2]. Here, we demonstrate spin-resolved detection of single ultracold molecules in an optical lattice [3]. We perform a series of manipulations to project the rotational state of the molecules onto atomic species [4] and use a dual-species quantum gas microscope to detect tagging atoms with single-site resolution (see Fig. 1). Through local addressing of the molecular sample, we are also able to probe the pinning of the molecules in the lattice in-situ.

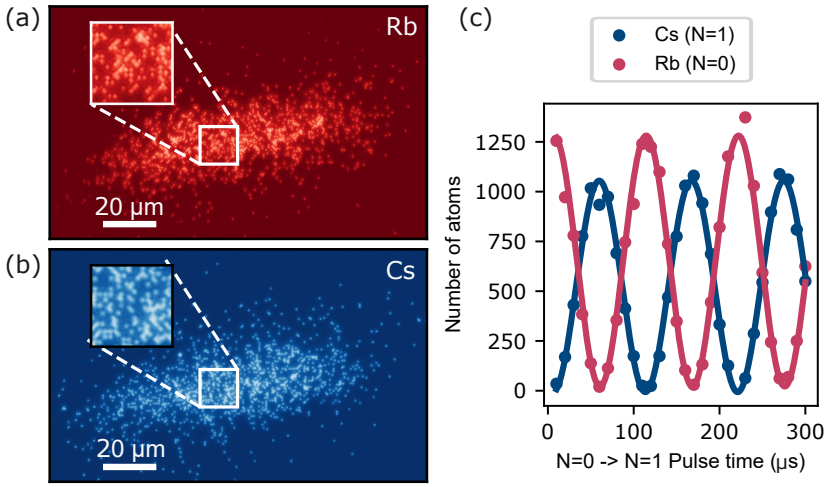

Figure 1: Spin-resolved microscopy of RbCs molecules. (a) and (b) show fluorescence images of Rb and Cs atoms respectively (with single atom resolution), prepared by dissociating RbCs molecules. (c) shows the observation of a Rabi oscillation when driving the molecule rotational transition, and mapping different rotational states to different species for imaging. Figure adapted from [3]

References

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