Highly Efficient Creation of Ultracold Ground-state ^{6}Li-^{40}K Polar Molecules

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Abstract

We report on the first and efficient creation of ground state ^{6}Li-^{40}K molecules using the stimulated Raman adiabatic passage (STIRAP) [1]. Starting from the weakly-bound Feshbach molecules, the STIRAP transfer to the singlet ro-vibrational ground state is achieved via an intermediate state in the $A^1\Sigma^+$ potential [2]. The coherent transfer is facilitated by two narrow-linewidth and low phase-noise lasers. We achieved a single-trip transfer efficiency of 98(2) %, which is the highest compared to other reported bi-alkali species [3]. Our work demonstrates the high efficiency of the singlet STIRAP pathway for the coherent creation of ground state molecules. Combined with the high dipole moment of ground state ^{6}Li-^{40}K, this work paves the way for studying quantum chemistry, quantum simulation of exotic phase of matter and quantum information processing with strong long-rage anisotropic interactions [4-6].

References

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Figures

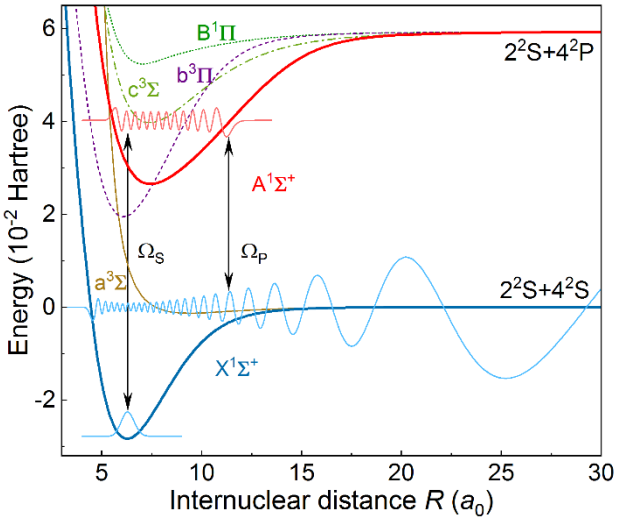

Figure 1: Adiabatic potential curves for ^{6}Li-^{40}K molecules. The singlet pathway connects the $X^1\Sigma^+$ ground state to the Feshbach state near the ground state asymptote via the $A^1\Sigma^+$ potential. The Rabi frequencies of the two coupling laser fields, Pump and Stokes, are indicated by Ω_P and Ω_S.

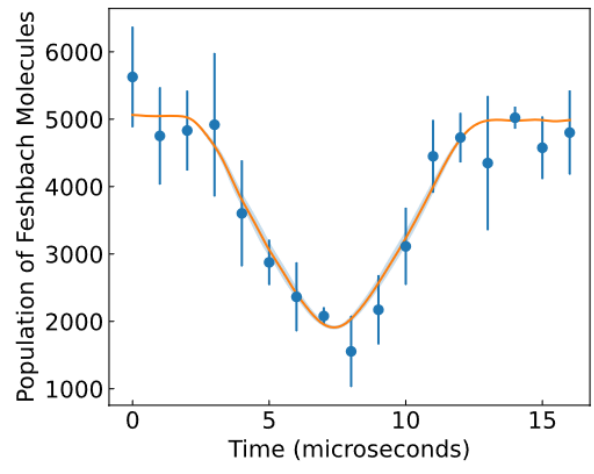

Figure 2: Round-trip trip STIRAP transfer. The single-trip STIRAP duration is 8 μs. The number of Feshbach molecules are detected by absorptive imaging. The detection background is caused by the un-associated Li atoms. Each data point is an average of 4 measurements. From a fit to a model based on the optical Bloch equations, we infer a single-trip STIRAP efficiency of 98(2) %.