Towards Li_2 and LiRb ground state molecules

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Abstract

In this talk I will focus on our efforts to create triplet ground state $^6Li_2$ and $^6Li^{85}Rb$ molecules. In both cases ultracold atoms will be turned into weekly bound Feshbach molecules and then transferred into the lowest lying state via an intermediate molecular potential using STIRAP technique [1]. This technique is non-trivial for Feshbach molecules consisting of bosonic atoms becasue of their short lifetime, and therefore molecules need to be separated using 3D optical lattice. We believe, that this process will be less technically demanding for $^6Li_2$ because these Feshbach molecules are long lived. Of particular interest to us is a study of the stability of triplet molecules and possible mechanisms of their decay into singlet state. In addition, ground state Li_2 are desirable for experiments where femtosecond pulses will be used to align and spin these molecules for the eventual study of the collisional properties of molecular super-rotors in the ultracold regime.

$^6Li^{85}Rb$, a strongly polar heteronuclear dimer, has not yet been studied in great detail. Theoretical predictions and recent measurements of Feshbach resonances [2] revealed a very rich Feshbach spectrum, with the widest resonances ever observed in a heteronuclear mixture. This allows great felxibility of control of interactions. Perhaps the most interesting feature of LiRb is its relatively large electric dipole moment, 4.2 debye, in the singlet state. However, triplet ground state molecules are expected to have electric dipole moment of 0.5 debye, which is as large as that of the very widely studied KRb in its singlet state. Therefore, LiRb in its triplet ground state is a candidate molecule for the realization of lattice-spin models proposed in [3], which require polar molecules that also possess a magnetic dipole moment.

References

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