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The role of the molecular hyperfine structure to control ultracold molecular formation

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High efficiency production as well as the confinement and manipulation of ultracold molecules with external fields require a precise knowledge of their level structure. The transfer of the initially weakly bound ultracold molecules to their absolute ground state, relies on the existence of suitable electronically excited states allowing an efficient stimulated Raman adiabatic transfer (STIRAP). Due to the complexity of the problem little is known about the hyperfine structure of molecu- lar states, especially in case of the electronically excited ones. We propose an asymptotic model where the molecular hyperfine interactions are determined by the atomic hyperfine interaction [1]. This assumption is strictly valid for large internuclear distances when the exchange energy be- tween the two atoms is negligible. At shorter distances, the variation of the electronic current is expected to be small enough to allow the model for catching the essential of the hyperfine split- ting of the molecular levels. As a first step, we have determined potential energy surfaces (PES) for any internuclear distance considering the molecular spin-orbit and hyperfine interactions for a non-rotating molecule. I will present our results [2] on the hyperfine structure for the bosonic $^{39}K^{133}Cs$ and sermonic $^{40}K^{133}Cs$ molecules for excited molecular states which correlate to the K(4s $^2S_{1/2}$)+Cs(6p $^2P_{1/2,3/2}$) dissociation limits.

References

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