A PATH TO V=0 GROUND STATE COLD CESIUM MOLECULES

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One of the most exciting current challenges of the ultracold molecule researches is the production of large samples of ultracold molecules in their absolute ground state. In this respect, formation of ultracold molecules starting from Feshbach resonances is very promising. For instance, the lowest excited states of the Cesium dimer are of particular interest as intermediate states for a two-photon transfer process down to the rovibrational ground state. Among them, the two 0_u^+ first excited states potentials result from a strong spin-orbit coupling between the singlet $A^1\Sigma_u^+$ and the triplet $b^3\Pi_u$ electronic states. The mixed states can then be used as a triplet-singlet transfer state during an electric dipolar transition.

In this talk, we will discuss the excitation scheme which is currently planned in Innsbruck to convert an ultracold quantum gas of weakly bound Feshbach Cesium molecules into an ensemble of molecules in their absolute ground state, using a sequence of two STIRAP transfers. The first STIRAP step has been achieved recently, demonstrating for the first time the possibility to transfer more than 60% of the molecules down to a single ground state rovibrational level bound by more than 1000 cm^{-1}, using the 0_u^+ state as intermediate one for the excitation. This study allows the derivation of a new value for the dissociation energy of the cesium dimer ground state, with an accuracy improved by 3 orders of magnitude compared to the previous study of Lab. Aimé Cotton [a]

[a] C. Amiot and O. Dulieu, J. Chem. Phys. 117 5155 (2002).