

Complete quantum state preparation of the single molecular ions:  
Towards ultimate fs-laser experiments and ultra-cold chemistry

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For more than a decade, the translational degrees of freedom of trapped ensembles of molecular ions have efficiently been cooled to the few millikelvin through Coulomb interaction with simultaneously trapped and laser Doppler cooled atomic ions [1]. More recently methods to produce rovibrational cold ensembles of translationally cold molecular ions have as well been demonstrated [2,3]. In the talk, I will present our recent progresses towards generating a single molecular ion in its absolute ground state with respect to both its rovibrational motion and its motion in the external trapping potential [4,5], and discuss a few planned fs laser experiments as well as some prospects for investigating ion chemistry in the ultra-cold regime, i.e. at  $\mu\text{K}$ -temperatures and below.

## References

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