Depletion spectroscopy and internal-state thermometry of buffer-gas-cooled polar molecules

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We present a general technique for probing the internal-state distribution of electrically guided polar molecules [1]. Bright beams of buffer-gas cooled [2] molecules are guided by an electrostatic quadrupole guide and brought to a region with homogenous electric field. Here, a radio frequency field pumps molecules in a specific rotational state from guidable to non-guidable sublevels. Another bent piece of a quadrupole guide through a differential pumping section ensures that only molecules remaining in guidable states are detected by a quadrupole mass spectrometer. The population of the different rotational states can be derived from the depletion signal. This enables us to estimate the rotational temperature of the guided molecules.

Using this technique, we characterize our buffer-gas cell for different molecules, e.g. CH_3F, CF_3CCH,... and for different regimes, effusive and hydrodynamic. As the scheme is extremly simple to implement in experiments using beams of guided molecules, we expect it to be well-suited for characterization in future experiments, e.g., with a centrifuge decelerator [3].

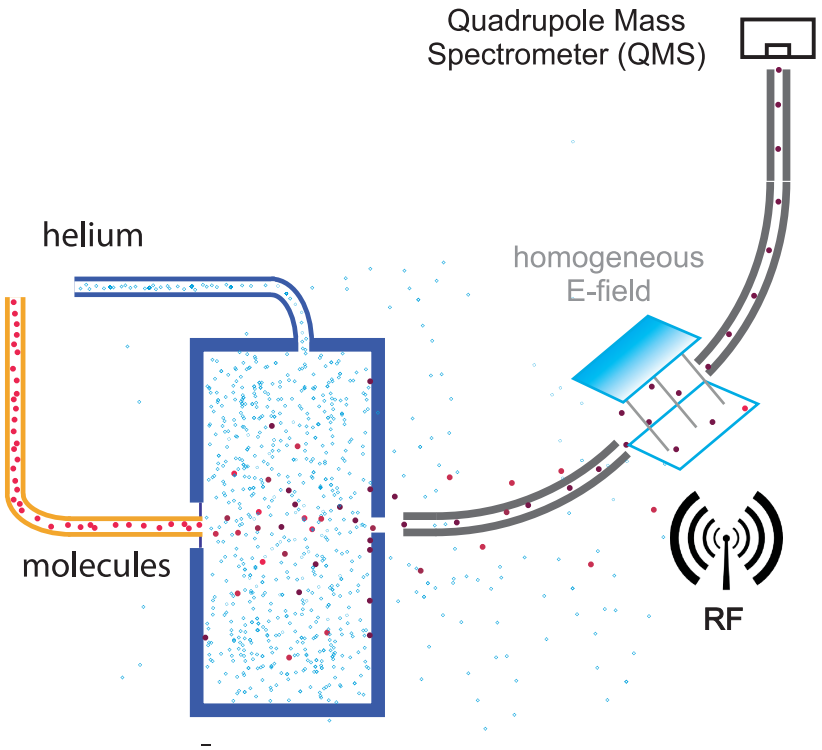

Figure 1: *RF spectroscopy setup*

References

[1] S.A. Rangwala *et al.* Phys. Rev. A **67**, 043406 (2003)
[2] L.D. van Buuren,*et al.* Phys. Rev. Lett. **102**, 033001 (2009)
[3] S. Chervenkov,*et al.* Phys. Rev. Lett. **112**, 013001 (2014)