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Internal-state thermometry of cold polyatomic molecules XING WU, THOMAS GANTNER, SOTIR CHERVENKOV, MARTIN ZEPPENFELD, GERHARD REMPE, Max-Planck-Institute of Quantum Optics — We present a new method for internal-state thermometry of guided polyatomic molecules. Bright beams of polar molecules are produced by a cryogenic buffer-gas cell and extracted by electrostatic guiding [1]. Their rotational-state distribution is probed via RF-resonant depletion spectroscopy. With the help of a complete trajectory simulation, resolving the guiding efficiency for all the thermally populated states, we are able to determine the internal temperature in the buffer-gas cell based on the RF depletion spectroscopy. This thermometry method is demonstrated for various regimes of buffer-gas cooling, beam formation, and for molecular species of different sizes, e.g., CH_3F and CF_3CCH. The results provide strong evidence that the collisional relaxation for rotational degrees of freedom is faster than for translational ones. In addition, the relaxation rates for states with different K-quantum number appear to be different.

[1]L.D. van Buuren et al., Phys. Rev. Lett. 102, 033001 (2009)

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