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Detecting and manipulating the rotational states of trapped polyatomic molecules ALEXANDER PREHN, ROSA GLÖCKNER, MARTIN IBRÜGGER, MARTIN ZEPPENFELD, GERHARD REMPE, Max-Planck-Institute of Quantum Optics — Many applications of cold and ultracold molecules require the ability to detect and manipulate internal states. Well established state-detection schemes (e.g. REMPI, LIF) often rely on the excitation of electronic states. However, this can lead to rapid predissociation, especially for many polyatomic molecules and thus limits their usefulness. Here we present an alternative detection method based on depletion of molecules in selected rotational states from an electric trap.[1] The narrow electric-field distribution of our trap[2] allows us to spectroscopically address desired sets of states with microwave and infrared radiation and couple them to untrapped states, thus removing them from the trap and leading to a state-selective loss. Experimental data obtained with methyl fluoride (CH_3F) agrees nicely with rate equation models.[3] Our method can be extended to allow for optical pumping of rotational states via a vibrational excitation. As we rely on generic properties of symmetric top molecules, application to other molecule species should be straightforward.

[1]B.G.U. Englert *et al.*, Phys. Rev. Lett. **107**, 263003 (2011)
[2]R. Glöckner *et al.*, arXiv:1411.7860 (2014)
[3]Glöckner *et al.*

Alexander Prehn
Max-Planck-Institute of Quantum Optics

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