Abstract Submitted
for the DAMOP12 Meeting of
The American Physical Society

A Quantum Optics Toolbox for Polyatomic Molecules MARTIN ZEPPENFELD, BARBARA G.U. ENGLERT, ROSA GLOECKNER, ALEXANDER PREHN, GERHARD REMPE, MPi for Quantum Optics — We present a combination of techniques to manipulate the external and internal degrees of freedom of polyatomic molecules. A novel microstructured electric trap[1,2] provides ideal motional control for polar molecules, generating a box-like potential with tuneable homogeneous electric fields over a large fraction of the trap volume and high trapping fields only near the trap boundary. The combination with radiation fields to manipulate the internal degrees of freedom allows full control of the molecules. Specifically, microwave and RF fields couple rotational states. Vibrational excitation via an infrared laser provides a dissipative spontaneous decay. The homogeneous fields inside the trap allow individual states to be selectively addressed. As first applications, we have realized adiabatic cooling[3] and opto-electrical cooling.[4] Further improvements will allow fundamental experiments with a wide range of polyatomic molecules at ultracold temperatures.

[1]M. Zeppenfeld *et al.*, Phys. Rev. A **80**, 041401 (2009)
[2]B.G.U. Englert *et al.*, Phys. Rev. Lett **107**, 263003 (2011)
[3]Ibid.
[4]Zeppenfeld, op. sit.

Martin Zeppenfeld
MPi for Quantum Optics

Date submitted: 26 Jan 2012 Electronic form version 1.4