

**CHARGED MECHANICAL OSCILLATORS COUPLED TO VARIOUS  
QUANTUM SYSTEMS**

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At NIST, we're investigating the coupling of charged mechanical oscillators to various systems, with the goal of exploring the quantum regime. A precursor to recent work is provided by the coupling of the internal states of an atomic ion to its quantized mechanical motion [1]. In a practical extension of this work, we couple one atomic ion qubit species to another through their (shared) mechanical motion, and realize efficient detection [2]. We have also recently observed passive cooling of a (charged) micro-cantilever by coupling it to a driven RF resonant circuit [3], similar to the cooling of cantilevers coupled to driven optical resonators. In the quantum regime, this cooling would be analogous to resolved sideband laser cooling of an atom. Other candidates being investigated include coupling a laser-cooled ion's motion or that of a group of ions to a mesoscopic harmonic oscillator, either mechanical or electromagnetic.

\* In collaboration with the other members of the NIST Ion Storage Group (<http://tf.nist.gov/ion/index.htm>)

- [1] D. M. Meekhof *et al.*, Phys. Rev. Lett. **76**, 1796 (1996).
- [2] T. Rosenband *et al.*, arXiv:physics/0703067.
- [3] K. R. Brown *et al.*, submitted.