Hybrid Quantum Systems with Trapped Charged Particles
SHLOMI KOTLER, DIETRICH LEIBFRIED, RAYMOND SIMMONDS, DAVE WINELAND, NIST - Boulder — We will review a joint effort by the Ion Storage Group and the Advanced Microwave Photonics Group at NIST (Boulder, CO) to design a hybrid system that interfaces charged particles with macroscopic high-Q resonators. We specifically consider coupling trapped charges to superconducting LC resonators, the mechanical modes of Silicon-Nitride membranes, and piezoelectric materials. We aim to achieve the strong coupling regime, where a single quantum of motion of the trapped charge can be coherently exchanged with harmonic motion of the macroscopic entity (electrical and/or mechanical). These kind of devices could potentially take advantage of both macroscopic control techniques and the long quantum coherence of its trapped charged particles.