Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Levitated Quantum Nano-Magneto-Mechanical Systems MAURO CIRIO, JASON TWAMLEY, GAVIN K. BRENNEN, Centre for Engineered Quantum Systems, Macquarie University, Sydney Australia, GERARD J. MILBURN, Centre for Engineered Quantum Systems, University of Queensland, Brisbane, Australia — Quantum nanomechanical sysems have attracted much attention as they provide new macroscopic platforms for the study of quantum mechanics but may also have applications in ultra-sensitive sensing, high precision measurements and in quantum computing. In this work we study the control and cooling of a quantum nanomechanical system which is magnetically levitated via the Meissner effect. Supercurrents in nano-sized superconducting loops give rise to a motional restoring force (trap), when placed in an highly inhomogenous magnetic field and can yield complete trapping of all translational and rotational motions of the levitated nano-object with motional oscillation frequencies $\nu \sim 10 - 100$MHz. As the supercurrents experience little damping this system will possess unprecendented motional quality factors, with $Q_{motion} \sim 10^9 - 10^{13}$, and motional superposition states may remain coherent for days. We describe how to execute sideband cooling through inductive coupling to a nearby flux qubit, cooling the mechanical motion close to the ground state.

Mauro Cirio
Centre for Engineered Quantum Systems,
Macquarie University, Sydney Australia

Date submitted: 24 Nov 2010 Electronic form version 1.4