Abstract Submitted
for the DAMOP14 Meeting of
The American Physical Society

Short range force measurements with optically trapped and cooled micro-spheres[1] DAVID ATHERTON, GAMBHIR RANJIT, JORDAN STUTZ, MARK CUNNINGHAM, DAVID KARR, ANDREW GERACI, The University of Nevada, Reno — In ultra-high vacuum, optically-trapped and cooled dielectric microspheres show great promise as force sensors–the environmental decoupling of their center-of-mass motion enables sub-attonewton sensitivity. Hence, they can be used to investigate Casimir forces or for testing non-Newtonian gravity. We are developing an apparatus to trap and cool silica spheres in a combined optical dipole-cavity trap. We describe our experimental results on optical trapping and cooling and our progress towards demonstrating the sensitivity of the technique. Ultimately, with a sphere trapped in an anti-node close to an end-mirror of the cavity, Casimir forces due to the end-mirror will be measured as a frequency shift of the oscillator. These measurements of the Casimir force will be in a previously unexplored regime between the Force Proximity Approximation and the Casimir-Polder approximation. Discrepancies between the strength of gravity and other Standard Models forces suggest corrections to Newtonian gravity at the sub-millimeter length scale. Non-Newtonian gravity-like forces will be tested by monitoring the displacement of the sphere as a mass is brought behind the cavity mirror.

[1]NSF PHY-1205994

David Atherton
The University of Nevada, Reno

Date submitted: 31 Jan 2014 Electronic form version 1.4