Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Optomechanical Levitation of Tethered Dielectrics in a Cavity TINA MÜLLER, CHRISTOPH REINHARDT, BOGDAN PICIÚ, ABEER BARASHEED, SIMON BERNARD, ALEXANDRE BOURASSA, XINYUAN ZHANG, CHRISTOPHER MCNALLY, JACK SANKEY, McGill University, MCGILL OPTOMECHANICS LAB TEAM — Optically supporting dielectric materials has the potential to increase their mechanical quality factors Q far beyond the limits set by material dissipation. As the mechanical frequency ω increases due to the applied optical spring, the quality factor increases as ω^2, meaning that the overall dissipation rate decreases and the mass experiences less force noise from the environment. However, a major limitation when trapping weakly tethered dielectrics is the mode mixing with the low-Q mechanical modes of the tethers, occurring when the frequency of the trapped element becomes degenerate with the tether mode frequencies. In addition, the maximum trap strength is limited by the maximum optical power a dielectric can be exposed to before breakdown. Here, we describe an optimal system to overcome these limits, based on a straightforward cavity levitation scheme and controlling the position and angle of the mechanical element via its tethers. We also show progress towards trapping a SiN tethered membrane with our scheme, and discuss implementations based on other materials.

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Date submitted: 14 Nov 2014 Electronic form version 1.4