Progress Towards Non-Newtonian Gravity Searches with Optically Levitated Force Sensors

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Due to their large degree of mechanical isolation, optically levitated objects make excellent force sensors and are therefore of interest to fundamental physics research. In particular, optically levitated force sensors have the potential to probe unexplored parameter space in the search for deviations from Newtonian inverse-square law gravity at the micron scale. I will describe the progress towards this goal utilizing 300 nm diameter silica spheres in a retro-reflected standing wave trap near a metalized membrane at high vacuum. Additionally, I will discuss how these force sensors can be positioned in 3D relative to the gold-coated reflective surface and used as a scanning probe microscope (SPM). The ability to use an SPM *in-situ* to scan the surface is useful for ultra-sensitive experiments where forces by the surface on the particle become backgrounds for the desired physics signals.