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Precision force sensing with optically-levitated nanospheres[1]

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In high vacuum, optically-trapped dielectric nanospheres achieve excellent decoupling from their environment and experience minimal friction, making them ideal for precision force sensing. We have shown that 300 nm silica spheres can be used for calibrated zeptonewton force measurements in a standing-wave optical trap. In this optical potential, the known spacing of the standing wave anti-nodes can serve as an independent calibration tool for the displacement spectrum of the trapped particle. I will describe our progress towards using these sensors for tests of the Newtonian gravitational inverse square law at micron length scales. Optically levitated dielectric objects also show promise for a variety of other precision sensing applications, including searches for gravitational waves and other experiments in quantum optomechanics.

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