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Characterization of precise force sensing by optically-levitated microspheres AKIO KAWASAKI, ALEXANDER D RIDER, CHARLES P BLAKEMORE, NADAV PRIEL, ALEXANDER FIEGUTH, SANDIP ROY, GIORGIO GRATTA, Stanford University — Optically levitated micro- and nano-spheres have been used for various purposes from a precise force sensor to a quantum mechanical superposition in mesoscopic systems. We have constructed a novel system to trap a 2.4 μm radius microsphere by a single upward-propagating laser beam. Position sensing based on interferometry enables us to apply feedback cooling and detect the microsphere position with a single trapping beam. We present the characterization of a precision force sensor with force sensitivity of $\sim 10^{-17}$ N/$\sqrt{\text{Hz}}$ for all of the three translational degrees of freedom. This force sensor is a promising system for the search for non-Newtonian gravity at the distance scale of 1-100 μm range.

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