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The DC Force Exerted on a Charged Microparticle by an AC Electric Field DENNIS C. PRIEVE, CHRISTOPHER L. WIRTH, PAUL J. SIDES, Carnegie Mellon University — In 0.15 mM solution of KOH or NaHCO3 in water, a single negatively charged 6-micron polystyrene sphere is levitated about 200 nm above a negatively charged planar ITO electrode by double-layer repulsion. The potential energy profile of forces acting on the sphere is determined by monitoring the distribution of elevations sampled by Brownian motion of the sphere and measured using total internal-reflection microscopy, which can detect changes in elevation as small as 1 nm. Application of a 10 kV/m electric field oscillating at 10 kHz produced oscillations in elevation which were completely swamped by Brownian motion. Nonetheless an unexpected steady attractive force was detected which was comparable in magnitude to the net weight of the sphere (0.05 pN). This additional force was proportional to the square of the electric field amplitude and is about a factor of 2 stronger in KOH compared to NaHCO3. The DC force appears to be dielectrophoretic attraction resulting between aligned dipoles induced in the sphere and the planar electrode by the electric field [Dietz, J. Appl. Phys. 48, 1036 (1977)]. A similar force causes "necklaces" of colloidal particles to form.

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