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A Brownian dynamics simulation of a colloidal particle in an alternating electric field very near an electrode LEI WANG, DENNIS PRIEVE, Carnegie Mellon University — In previous experiments, a single 6 μm sphere, immersed in a 0.15 mol/m^3 electrolyte solution, was put in an alternating electric field (6 kV/m, 100 Hz to 10 kHz) acting normal to a nearby planar electrode. Even in the absence of the applied field, the particle is confined by a potential energy well formed by gravitational attraction and double-layer repulsion. While monitoring the elevation of the particle (order of 300 nm) with Total Internal Reflection Microscopy at millisecond intervals and with the AC field, the particle was observed to experience a steady attraction to the electrode, even when the deterministic oscillations were imperceptibly small. While dielectrophoresis could produce a steady attraction, the observed attraction has a frequency dependence which is not consistent with this force. In this work, we use Brownian dynamics simulation to explore the role of several nonlinearities in the equation of motion: 1) a position-dependent drag coefficient, 2) a position-dependent oscillating force and 3) a non-parabolic shape for the confining potential energy profile (non-linear spring).

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