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Bifurcation in the equilibrium height of colloidal particles near an electrode in oscillatory electric fields TAYLOR WOEHL, BING-JIE CHEN, KELLEY HEATLEY, NICHOLAS TALKEN, CARI DUTCHER, WILLIAM RISTENPART, Dept. Chemical Engineering and Materials Science, University of California Davis — Application of an oscillatory electric field is known to alter the equilibrium separation distance between micron-scale colloidal particles and an adjacent electrode. This behavior is believed to be partially due to a lift force caused by electrohydrodynamic (EHD) flow generated around each particle, with previous work focused on identifying a single equilibrium height of the individual particles over the electrode. Here we report the existence of a pronounced bifurcation in the equilibrium particle height in response to low frequency electric fields. Optical and confocal microscopy observations reveal that application of a $\sim$100 Hz field induces some of the particles to rapidly move several particle diameters up from the electrode, while the others move closer to the electrode. The fraction of particles that exhibit this "extreme levitation" increases with increased applied potential and decreased frequency, in a fashion qualitatively consistent with an energy landscape predicated on competition between EHD flow, colloidal interactions, and gravity. Taken together, the results provide evidence for the existence of a deep tertiary minimum in the electrode-particle interaction potential at a surprisingly large distance from the electrode.

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