Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Dielectric decrement effects in electrokinetics BRUNO FIGLIUZZI, Ecole des Mines ParisTech, WAI HONG RONALD CHAN, Stanford University, CULLEN BUIE, JEFFREY MORAN, Massachusetts Institute of Technology —
Understanding the nonlinear phenomena that occur in the electric double layer (EDL) that forms at charged surfaces is a key issue in electrokinetics. In recent studies, Nakayama and Andelman [J. Chem. Physics 2015] Hatlo et al. [EPL 2012], and Zhao and Zhai [JFM 2013] demonstrated that dielectric decrement significantly influences the ionic concentration in the electric double layer (EDL) at high zeta potential, leading to the formation of a condensed layer near the particle's surface. In this presentation, we apply the dielectric decrement model to study two archetypal problems in electrokinetics, namely the electrophoresis of particles with fixed surface charges and the electrophoresis of ideally polarizable particles. Our aim is to rely on numerical simulations to incorporate nonlinear effects including crowding effects due to the finite size of ions, dielectric decrement in the EDL, surface conduction, concentration polarization and advection in the bulk solution. In parallel, we derive a simplified composite layer model that enables us to obtain analytical estimates of the physical quantities involved in the physical description of the problem.

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Date submitted: 31 Jul 2015 Electronic form version 1.4