Abstract Submitted
for the DFD07 Meeting of
The American Physical Society

Nonlinear electro-phoresis of conducting particles EHUD YARIV, Technion — When an initially-charged conducting spherical particle is placed under an externally-imposed uniform electric field, its surface-charge distribution is modified from its original uniform state, and the Debye layer adjacent to its boundary is accordingly polarized. The ensuing asymmetric zeta-potential profile leads to electrophoretic particle motion. In the thin-Debye-layer limit, this problem is characterized by three voltage scales, associated with the respective effects of initial charge, applied field, and ionic thermal motion. Charge conservation provides an implicit relation between the electrophoretic mobility and these quantities. Due to the nonlinear Debye-layer capacitance, the electrophoretic mobility differs from that of a dielectric particle possessing the same net electric charge. The mobility dependence upon the applied-field magnitude and the initial charge is investigated using both direct and asymptotic methods. The inherent nonlinearity results in some counter-intuitive effects, the most notable of these is the mobility subsidence for strongly-applied fields.

Ehud Yariv
Technion

Date submitted: 24 Jul 2007 Electronic form version 1.4