

Understanding Electrokinetics at the Nano-Scale

Both AC and DC electrokinetic techniques have become popular in microfluidics and nanofluidics. However, as we approach Debye screening length dimensions, peculiar ion transport and flow phenomena, many with electrophysiological and semi conductor analogies, arise and demand a fresh look at classical electrokinetic theories. In this talk, I will review some of these anomalous nano-electrokinetic phenomena: nonlinear I-V characteristics, negative differential resistance, rectification and gating, double-layer instability, oscillatory and chaotic discharge, contact-line and Taylor cone breakdown, nanodrop ejection etc-----and attribute them to dynamic double-layer charging, field-focusing, asymmetric polarization, extended space charge build-up, charge and mobility selectivity, and field-induced hydrodynamics ---all poorly understood physical phenomena unique to electrokinetics at the nanoscale.

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