

# PHYSICAL MATHEMATICS SEMINAR

## INDUCED-CHARGE ELECTRO-OSMOSIS AND ELECTROPHORESIS

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### ABSTRACT:

Motivated by the recent discovery of AC electro-osmosis at micro-electrode arrays, we predict the general phenomenon of "induced-charge electro-osmosis" (ICEO) -- the slip of a liquid electrolyte at a polarizable (metal or dielectric) surface when an electric field acts on its own induced surface charge -- which requires neither AC forcing, nor electrode surfaces. Building on some earlier Russian work on metal colloids, we also predict the related effect of "induced-charge electrophoresis" (ICEP) - the motion of a polarizable particle due to ICEO flow with broken symmetries, such as partial surface coatings, asymmetric shapes, and non-uniform applied fields (where "dielectrophoresis" due to electrostatic stresses must also be considered). We obtain analytical solutions for simple geometries and solve the general ICEP problem in two dimensions for any shape and non-uniform field by conformal mapping; more complicated geometries are studied by numerical methods. Although our understanding of ICEO is maturing, fundamental questions remain about "strongly nonlinear" dynamics in large, time-dependent applied fields.

To complement the mathematical theory, we also present novel experiments demonstrating ICEO in microfluidic devices and discuss applications to portable (or implantable) microfluidics.

**TUESDAY, SEPTEMBER 20, 2005**

**2:30 PM**

**Building 3, Room 370**

*Refreshments at 3:30 PM in Building 2, Room 349.*



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