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Breaking symmetries in induced-charge electro-osmosis and electrophoresis TODD SQUIRES, UCSB Chemical Engineering, MARTIN BAZANT, MIT Applied Mathematics — In induced-charge electro-osmosis (ICEO), an applied field induces an electric double-layer around a polarizable surface, and then forces that same induced double-layer to drive a nonlinear electrokinetic flow. This allows steady flows to be driven even with AC fields, unlike in standard electro-osmosis. In this talk, we discuss ICEO in systems in which a symmetry has been broken in any of a number of ways: conductors with inhomogeneous surface properties, asymmetrically-shaped bodies, and nonuniform electric fields. We highlight several paradigmatic examples that are interesting for both colloidal science and microfluidics. We describe the induced-charge electrophoretic motion of asymmetrically-shaped colloids, and provide principles for the design of metallic colloids that rotate to orient themselves in a desired direction, then translate in a desired direction relative to an applied electric field. In the microfluidic context, asymmetric conductors allow strong, steady microfluidic flows to be driven along channels with relatively small potentials applied across channels, suggesting methods for portable, self-powered microfluidic devices.

Todd Squires
UCSB Chemical Engineering

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