



**Driving Particles and Fluids Using Chemical Fluxes**

Todd Squires  
Professor and Vice Chair Chemical Engineering  
University of California-Santa Barbara

**Abstract**

Suspensions of micron-scale particles and drops are ubiquitous in complex fluid formulations — foods, consumer products, pharmaceuticals, paints, coatings, and other materials and precursors. A number of equilibrium interactions have long been exploited to stabilize these suspensions and tune the properties of the materials. Here, we describe a set of non-equilibrium, chemical phenomena that allow particle migration to be directed and controlled over significantly longer ranges than is possible with equilibrium interactions. Examples will build upon somewhat classic pictures of diffusiophoresis or solvophoresis, wherein fluxes of various chemical species quite generically drive fluid flows and particle migration. We will lay out a conceptual, intuitive framework to understand, design, and manipulate these chemical fluxes — and illustrate with systems that drive particles into or out of dead-end pores; where particles might ‘find’ targets hidden within a maze, and where structures may collect specific suspended particles from millimeters away.

We will additionally describe new techniques we have developed to sculpt chemical micro-environments in space and time, and interferometric methods to visualize these concentration fields as they evolve. We will illustrate with direct, dynamic measurements of physical and reactive absorption of vapor-phase solutes into ionic liquids, reagent depletion during interfacial polymerization reactions, and diffusion of associative solutes through hydrogels.

**Friday, April 5**

**3:00 pm**

**Livermore 101**