



# "Soft-Matter Seminar"

Dr. David M. Huang

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## Title

**Fluid structure and dynamics near hydrophobic surfaces: from protein folding to microfluidic flow control**

## Abstract

Hydrophobic surfaces are responsible for many surprising and potentially useful effects, such as hydrodynamic slippage and nanobubble formation. A common feature underlying many of these phenomena is the formation of a layer of depleted water density near macroscopic hydrophobic surfaces, which does not, however, occur near small hydrophobic solutes. I will present computer simulation and theoretical results for the interfacial fluid structure near hydrophobic solutes and solvation free energy that demonstrate the crossover between the small and large length-scale regimes of hydrophobic solvation. I will also discuss the relevance of these results to the physics of biological processes such as protein folding. I will then demonstrate the implications of surface hydrophobicity and interfacial solvent depletion for fluid transport in microfluidic ("lab-on-chip") devices and biological membrane channels. In particular, I will present computer simulation results that illustrate the interesting electrokinetic effects that arise for electro-osmotic flow in hydrophobic channels for electrolytes with significant cation/anion size asymmetry, due to the stronger attraction of the larger ion to the "vapour-liquid-like" interface induced by the hydrophobic surface. I will also present a simple model for predicting the fluid flow profiles that uses continuum hydrodynamics and a modified Poisson-Boltzmann description for the ion density distributions.

**Dienstag, den 20.11.2007**

**13:00 Uhr**

**Raum 3344**

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