Theoretical studies of electrohydrodynamics (EHD) in charged complex geometries.

Due to the strong non-linarites, only approximate analytic solutions are known to the Poisson-Nernst-Planck problem - even for simple geometries. Here we present numerical simulations using a lattice Boltzmann method (LBM) for the combined system of Poisson's, Nernst-Planck's, and Navier-Stokes' equations. Our method makes it possible to study the fluid permeability and the charge conductivity in porous media. This makes it possible to model semi-ionselective membranes, i.e. membranes that allow different ion types to pass at different rates. Semi-ionselective membranes are suspected to have a none simple charge current response if a bias voltage is applied over them, which our method hopefully can shed light on.