Mesoscopic simulations of electrohydrodynamic colloidal suspensions.

N. Rivas[1] and J. Harting[1]

[1]Forschungszentrum Jülich GmbH, Helmholtz Institute Erlangen-Nürnberg for Renewable Energy (IEK-11), Fürther Straße 248, 90429 Nürnberg

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Electrokinetic effects play a crucial role in many natural and technological systems, from the biological to nano-fluidics. Numerical simulations of conducting fluids present a significant challenge mainly due to the variety of length-scales involved, and the presence of two long-range interactions: hydrodynamic and electrostatic. In this presentation we give a general overview of an electrohydrodynamic mesoscopic model and present results on the dynamics of colloid-coated droplets. The hydrodynamics of two fluids is solved using the lattice-Boltzmann method. Ions present in the solvents are considered at the level of the Nernst-Planck equation, which is solved via a finite-volume, finite-difference discretization, following the link-flux method. Furthermore, colloids are added using a novel discretization scheme that prevents large velocity fluctuations. We show that the simulation scheme is robust and has excellent parallel scaling up to thousands of processors. We then present simulation results on the deformation, merging and splitting of colloid-coated droplets in external electric fields.