Seminar

Tuning Electrostatic Interactions in Soft Matter Beyond the Debye–Hückel Theory

by

Dr. Meng Shen

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Date : 29 January, 2019 (Tuesday)
Time : 11:00 am
Venue : Lecture Theater K (via lifts 31-32)

Abstract

Electrostatics interactions provide tunability for the properties of soft materials, such as the dispersion of colloids in a solution, and the transport of ions in composites. The electrostatic interactions are sensitive to various tuning parameters including solvent permittivity, electrolyte valence, size and concentration, and interfaces. Despite long-term usage of electrostatics in controlling the soft matter properties, such as the buffer system in biology, new discoveries in experiments keep challenging the previously accepted theoretical understandings. Here I will discuss about our recent computational work on the effects of surface polarization on the electrostatic interactions between ion-containing emulsions, the effects of electrolyte concentration on the interactions between colloids, and the effects of the low dielectric medium on one-dimensional self-assembly of macrocycle nanotubes. The research sheds light on why classical electrostatic theories, such as the Debye–Hückel theory and even the non-linear Poisson Boltzmann theory, break down in recent electrostatic-mediated experiments. It also opens more venues for tuning the electrostatic effects in soft matter.

Biography

Meng Shen is currently a postdoctoral scholar in the Institute of Molecular Engineering (IME) at the University of Chicago, working on mechanical metamaterials and transport in polymer. From 2016 to 2018, she worked in the group of Prof. Monica Olvera de la Cruz in the Dept. of Materials Science and Engineering at Northwestern University, and focused on multiple effects of electrostatics on self-assembly of soft matter. From 2014-2015, she worked as a postdoctoral fellow in the Dept. of Mechanical Engineering at Northwestern University, and explored the computational research on the transport mechanisms of organic contaminants through polyamide reverse osmosis membranes. She earned her PhD in Materials Science and Engineering, at Rensselaer Polytechnic Institute, Troy, NY in 2013, with the thesis on nanoscale heat transfer.