סמינר מחלקתי – הנדסת חומרים

הנך מוזמן בזאת לסמינר אשר יתקיים ביום ה', 9 בנובמבר 2017, כ' בחשון תשע"ח
בשעה 14:00, בניין 51 חדר 15 (באודיטוריום)

From solvent free to dilute electrolytes: A unified continuum approach

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Electrically interacting molecules are viable to our everyday life both explicitly and implicitly, examples of which include propagation of electrical impulses (i.e., action potentials) along nerve system and photosynthesis in plants. While biologically related energy mechanisms are indeed profound and intriguing, it is the ever increasing man-made technologies that stimulate the soft-matter applications and specifically the electrochemical ones toward green energy devices (solar cells, batteries, and fuel cells). The scientific challenges are thus mostly focus on devising the complex physocochemical nature of heterogeneous electrolytes, such as, polymers, polyectrolytes, micro- and macro-emulsions, nano-particles and ionic liquids. To date mean-field theories offer only corrections to dilute electrolytes and thus, cannot be exploited to tackle the challenging properties of ionic liquids that exhibit nano-structuring (self-assembly) and transport beyond Einstein-Stokes relations.

I'll present a novel mean-field framework for electrolytes that is thermodynamically consistent at any concentration level. This challenge requires an explicit inclusion of a solvent to address both interactions (free energy) and dissipation mechanisms (Onsager's relations). Respectively, these essential spatiotemporal components are being formulated in a unified framework for a ternary composition comprising ions and neutral species, and capture all qualitatively distinct asymptotic and dynamical properties in either bulk or fluid/solid interface. In particular, the framework qualitatively recovers the full range of non-monotonic electrical screening length that has been recently observed in experiments using organic solvent to dilute ionic liquids.

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