

Selected Topics in the Theory of Soft Matter:

*From statistical field theory of charged mesoscopic systems
to simulations of diffusion on fluctuating membranes*

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Lecture 1: Novel electro-statistical phenomena in bio-soft matter:

Overview of recent advances

Statistical field theory of confined Coulomb gas:

Analytical approach to interactions of macroions in biological media

Lecture 2: Weak-coupling fluctuation-induced interactions & Casimir effect

Lecture 3 Strong-coupling theory of highly charged systems:

Theory and simulations of attraction between like-charged macroions

Lecture 4 Theory of charge disorder--quenched & partially annealed disorder:

Application of replica theory to interactions of randomly charged macroions

Lecture 5 Methods of hydrodynamic simulations:

Applications to DNA electrophoresis, & Diffusion on fluctuating elastic membranes

Place: School of Physics, Institute for Studies in Fundamental Sciences,
Farmanieh Building, Farmanieh St., Next to Kooh-e-Noor Building,
Tehran

Schedule: Lecture 1 Monday, 12 Esfand 1387 (2 March 2009), 4:00-5:30pm
Lecture 2 Tuesday, 13 Esfand 1387 (3 March 2009), 4:00-5:30pm
Lecture 3 Monday, 19 Esfand 1387 (9 March 2009), 4:00-5:30pm
Lecture 4, Tuesday, 20 Esfand 1387 (10 March 2009), 4:00-5:30pm
Lecture 5, Wednesday 21 Esfand 1387 (11 March 2009), 4:00-5:30pm

Abstract: Mesoscopic charged objects or “macroions” such as charged polymers (e.g. DNA and RNA), plasma membranes, colloids and proteins are abundant in soft-matter and biological systems. Electrostatic interactions lead to many counter-intuitive and novel phenomena in these system (such as like-charge attraction and condensation of DNA and other highly charged macroions) that have been at the focus of recent studies in the theory of bio-soft matter. We briefly discuss some of recent advances from a physicist’s point of view and present in detail the field-theoretical and replica techniques applied recently to study various phenomena in this field. Methods of numerical simulations will be discussed as well both in the context of charged systems and diffusion of inclusions in biological membranes.

Note: The above schedule is subject to change, please check the ipm/physics website <http://physics.ipm.ac.ir/> for updates or email anaji@chem.ucsb.edu