

Electrostatic Interactions in Soft and Biological Matter

I. General Overview

- 1) Ions in soft matter and biology
- 2) Electrostatics
- 3) Thermodynamics and Statistical Physics

II. The Poisson-Boltzmann theory

- 1) The Poisson-Boltzmann equation
- 2) Debye-Huckel theory
- 3) The planar problem: one and two-plate system
- 4) The cylindrical case: counterion condensation
- 5) Spherical geometry and colloids

III. Statistical Field Theory of Charged Systems

- 1) Field theory formulation of charged systems
- 2) The loop expansion
- 3) Some applications: interaction of charges in a salt solution, fluctuations, surface tension,...

IV. Further Applications

- 1) Role of short range interactions: the sterically modified Poisson-Boltzmann equation
- 2) Field theory of dipolar fluids
- 3) Like-charge attraction