



The Physics of Soft and Biological Matter

P.31 Two-fluid model for ions distribution on a charged surface: A Monte Carlo study and modified Poisson-Boltzmann theory

C-H Cheng

Department of Physics, National Changhua University of Education, Taiwan

It is generally believed that in the weak coupling regime, ion-ion correlation is not important, and then the mean field theory is valid. In the salt-free solution (with counterions only), the density profile of the counterions is the Gouy-Chapman solution. With salts, the mean field result is the Poisson-Boltzmann solution.

We investigate carefully the counterions and coions distribution on a charged surface in the weak coupling regime by the Monte Carlo simulation. It is found that the ions distribution does not fit into the Poisson-Boltzmann theory at the intermediate salt concentration. The ions distribution favor a two-fluid model in which the counterions are composed of two parts. One is bound (or called condensed) and the other is free (or called mobile).

Based on the simulation result, we propose a new kind of mean field theory, the modified Poisson-Boltzmann theory, for the two-fluid model. It is found that the theoretical result agree with the simulation.