

Abstract Submitted
for the MAR07 Meeting of
The American Physical Society

Electrostatics of DNA complexes with cationic lipids ANDREY CHERSTVY, Max Planck Institute for the Physics of Complex Systems, Nöthnitzer Straße 38, 01187 Dresden, Germany — We present the exact solutions of the linear Poisson-Boltzmann theory for several problems relevant to electrostatics of DNA complexes with cationic lipids. We calculate the electrostatic potential and energy for lamellar and inverted hexagonal phases, concentrating on the effects of water-membrane dielectric boundaries. Our results for the complex energy agree qualitatively well with the known numerical solutions of the nonlinear Poisson-Boltzmann equation. Using the solution for the lamellar phase, we calculate its compressibility modulus and compare our findings with experimental data available suggesting a new scaling dependence on DNA-DNA separations in the complex. Also, we treat analytically charge-charge electrostatic interactions across, along, and in between two low-dielectric membranes. We obtain an estimate for the strength of electrostatic interactions of 1D DNA smectic layers across a lipid membrane. We discuss also some aspects of 2D DNA condensation and DNA-DNA attraction in DNA-lipid lamellar phase in the presence of di- and tri-valent cations and analyze the equilibrium intermolecular separations using the recently developed theory of electrostatic interactions of DNA helical charge motifs.

Andrey Cherstvy
Max Planck Institute for the Physics of Complex Systems,
Nöthnitzer Straße 38, 01187 Dresden, Germany

Date submitted: 26 Dec 2006

Electronic form version 1.4