# How does helical structure effect correlation forces between DNA molecules?

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The Poisson-Boltzmann approximation of the electrostatic interaction between two macro-ions, immersed in salt solution, assumes that the interactions between ions are very weak. For helical molecules, by using such considerations, one may derive the Kornyshev-Leikin theory of interaction [1] to describe the long-range behaviour of the forces between them. However, there may be certain cases where Kornyshev-Leikin theory, on its own, may be insufficient in describing the interaction, especially at closer separations between macro-ions. For instance when the valance of salt ions and counter-ions are large, interactions between ions may give rise to short ranged correlation forces. These may be thought of as attractive forces due to fluctuations in the counter-ion and salt density, when correlations between ions are not too strong.

The shape of the mean counter-ion and salt density function about molecules could be very important. Helical structure in DNA may play an crucial role in the behaviour of such forces, as the positioning of phosphate charges indeed affect the structure of the mean distribution of counter-ions due charges. An important consequence is that DNA structure may, again, give rise to preferred orientations of molecules about their long axes: so called azimuthal correlations [2]. Indeed, in the limit of strong correlations this effect has been shown to be significant [3].

In this talk, I will show that for weak correlations one can derive expressions for correlation forces, which are in some ways analogous to those of the theory of [1]. However, because the density of small ions is important here, not the charge density, these forces could favour different azimuthal orientations between molecules than those forces originally considered in [1].

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