The effect of thermal fluctuations on elastic instabilities of biopolymers

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Stellingen

behorende bij het proefschrift

The effect of thermal fluctuations on elastic instabilities of biopolymers

1. One of the main sources of error and confusion in using polymer models to understand the spatial distribution of DNA in the cell arises when the importance of thermal energy as a gauge is neglected.

   Chapter 2

2. The buckling transition as a phase transition of the worm-like chain does not exist at finite temperature as Landau's argument shows. In reality biomolecules are not one-dimensional objects. That is why a sharp transition exists for finite temperatures, but to be able to make a better prediction of the buckling behaviour around the transition, more structural input than a worm-like chain is needed.

   Chapter 3

3. The surprising increase in length of the two-dimensional worm-like chain after the buckling transition can be understood from the asymmetric energy landscape with a lowest fluctuation mode that lengthens the buckled state.

   Chapter 3

4. The torsional buckling transition evades Landau's argument through non-local volume interactions. In that sense one can understand the multi-plectoneme phase as a critical point.

   Chapter 7

5. The argument that the south-pole evading links are a good substitute for an excluded volume is based on a misunderstanding of the paths one integrates over in the path integral.

   J. Samuel, S. Sinha & A. Ghosh J. Phys.: Cond.Mat. **18** S253 (2006)

6. The replacement of the electrostatic energy of two charged cylinders in a salt solution by a Debije-Hückel potential is a valid simplification based on a more complicated argument than one expects at first sight. (This in contrast to Odijk-Skolnick-Fixman theory that seems to rely on a straightforward argument, but is in fact much more mysterious.)

   N. Hoskin & S. Levine, Philos. Trans. R. Soc., A **248**, pp. 449–466 (1956)

7. When evaluating entropic effects in the repulsion of 2 semi-flexible polymers one should not forget the importance of temperature. When taken into account, a rich variety of regimes appears with distinct physical properties.

T.Odijk, Phys. Rev.E **77**, 060901 (R) (2008)

8. Gromovs symplectic rigidity pushes discussions about the interpretation of quantum mechanics back to discussions on what was the physics that started the noncommutativity of observables, since the classical Hamiltonian flow will never get rid of a fuzzy phase space.

M. Gromov - Invent. Math. **82** p:307 (1985)

9. The discovery of giant viruses like the mimi-virus, possessing the machinery to replicate itself, complicates the discussion of what life is.

Scola, et al. Science **299** p:2033 (2003)

10. The appearance of icosahedral symmetry in 2-dimensional lattices on a spherical surface is a result of a combination of topological and geometrical constraints.

M. Bowick, D. Nelson & A. Travesset, Phys. Rev. B**62** p:8738 (2000)

11. The present crisis in the Dutch real estate market is a consequence of the common failure of a supportive measure reaching the group that is targeted, in this case the house owners.