



"Soft-Matter Seminar"

Prof. Anatoly Kolomeisky
Rice University, USA

Title:

"How Proteins Find and Recognize Their Targets on DNA"

Abstract:

Protein-DNA interactions play a fundamental role in all biological processes. Proteins typically start its functioning after finding and recognizing specific sequences or sites on DNA. From experiments it is known that some proteins are capable to find their targets by 10-100 times faster than predicted by simple three-dimensional diffusion-limited rate. Current theoretical views suggest that protein molecules perform a facilitated diffusion search, moving part of the time along the DNA and part of the time in the bulk. However, this theoretical picture assumes that diffusion constants for 1D and 3D motions are of the same order, which contradicts latest single-molecule experiments. We present a theoretical approach which describes some aspects of the target search and recognition. In our approach the search process is viewed as a sequence of cycles, with each cycle consisting of 3D and 1D tracks. Our analysis shows that the acceleration in the search time can be reached by parallel scanning for the target by many proteins, and because of the increased local concentration of proteins due to non-specific interactions with DNA. We also show how the complementarity of the charge patterns on a target sequence and on the protein may result in electrostatic recognition of a specific track on DNA and subsequent protein pinning. We estimate the depth and width of the potential well near the recognition region as well as the typical time that a protein spends in the well. Our theoretical analysis agrees with current experimental single-molecule observations and bulk chemical kinetic studies.

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16:00 Uhr
Raum PH 3344

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