



"Soft-Matter Seminar"

Polymer translocation through a nano-pore: scaling, universality and prospective application[†]

Aniket Bhattacharya

Department of Physics
University of Central Florida Orlando, Florida 32816-2385
USA

Abstract:

The experimental studies of voltage driven translocation of a single stranded DNA through a α -hemolysin pore, have stimulated a lot of activities as the phenomenon is rich in fundamental science and its technical applications for detecting DNA/RNA sequences. In this talk I will present results for polymer translocation through a small pore obtained using a "Kremer-Grest" bead-spring model and Langevin dynamics simulation method. This talk is divided into two themes.

First I discuss some issues regarding scaling and universal aspects of a translocating polymer through a narrow pore driven by an external force. Particularly, I demonstrate from simulation results that there is a systematic variation of the scaling exponents as a function of the pore diameter. We find that the translocation exponent α ($\tau \sim N^\alpha$) decreases and the scaling exponent of the translocation (s) coordinate β ($s^2 \sim \tau^\beta$) increases as the width of the pore diameter is decreased from 1.5σ to 1.2σ . We notice that the exponent $\alpha = 1.2$ (extracted from chain lengths up to $N = 256$) not only violates the lower limit $1 + \nu$ proposed by Chuang Kantor and Kardar earlier but also lower than the more recently proposed limit $(1+2\nu)/(1+\nu)$ by Vocks.

In the 2nd half of my talk I discuss some aspects of translocation through an "attractive nanopore" where the components A and B of a heteropolymer $A_n B_m$ interact differently with the pore and discuss prospective applications. Specifically I demonstrate how characteristic fringe pattern exhibited by the "residence time" of the individual monomers can be used to design a device that can detect DNA sequences.

[†]

Some aspects of this work done in collaboration with Tapio Ala-Nissila, Kaifu Luo, Andrey Milchev, and Kurt Binder

**Friday, 29.05.2009
at 16:00
Room PH 3344**

Prof. Dr. Roland Netz
Physics Department T 37, Technical University Munich, Theoretical Physics
85747 Garching