Statistical Physics of Driven DNA: Scaling and Phase Diagram

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The separation of a double stranded DNA to two single stranded DNA below its melting point is a prerequisite for processes like transcription and replication. To execute such processes, various proteins work far away from equilibrium in a staggered way. In this talk, we shall discuss some aspects of unzipping of DNA under a drive in non-equilibrium conditions. We propose the dynamic transition, where without changing the physiological condition, it is possible to bring DNA from the zipped/unzipped state to a new dynamic (hysteretic) state by varying the frequency of the applied force. Our studies revealed that the area of the hysteresis loop grows with the same exponents as of the spin systems. We shall propose a steady state phase diagram of driven DNA, which along with scaling exponents are amenable to verification in force spectroscopic experiments.

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[3] Scaling of hysteresis loop of interacting polymers under a periodic force, R. K. Mishra, G. Mishra, D. Giri, and S. Kumar, J. Chem. Phys. (2013).