Modeling meiotic chromosomes in fission yeast - from polymer conformation to single file diffusion and back

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Abstract

In this contribution, we use a pinned loop polymer model to describe meiotic chromosomes in fission yeast. We show that the problem of finding the conformations of a pinned polymer loop in the external force field can be mapped to the corresponding problem of the single file diffusion. It allows us to find the exact solution for the equilibrium statistics of both systems, which turns out to be described by the Fermi-Dirac distribution. Moreover we can quantify not only the behavior of average positions of diffusing particles and monomers of the polymer loop but also their fluctuations. Fluctuations are affected by the constrains of the system and explicitly depend on the position. To close the loop of analogies we show that the kinetic Monte Carlo simulations, which can be performed for the single file diffusion with a well defined physical time, can be used to quantify the non-equilibrium dynamics of polymer loops.