Topological aspect of chromosome higher order structure

Takahiro Sakaue
(Department of Physics, Kyushu University)
e-mail: sakaue@phys.kyushu-u.ac.jp

Take a long flexible rope and try to pack it into a narrow box. How can we characterize the resultant structure? Well, the density would be the first thing to hit upon, which is very high, close to the maximum packing, but it misses the information on the entanglement, one of the essential aspects here. Given the fact that genomic DNAs in submicron and larger length scales can be modeled as flexible ropes, the above question would be pertinent to the higher-order chromosome organization in living cells. I will start with some basic concepts in polymer physics, and show how the topological effect becomes crucial in the dense system of ropes by taking a melt of ring polymers as an example. From this view point, there seem to be many interesting issues on the chromosome structure and dynamics.

References

1) T. Sakaue "Ring Polymers in Melts and Solutions: Scaling and Crossover" Phys. Rev. Lett., **106**, 167802 (2011).
2) T. Sakaue "Statistics and Geometrical Picture of Ring Polymer Melts and Solutions" Phys. Rev. E, **85**, 021806 (2012).