Universal Regimes of Semiflexible Polymers Confined in a Channel DOUGLAS TREE, University of Minnesota, YANWEI WANG, Soochow University, KEVIN DORFMAN, University of Minnesota — The problem of a semiflexible polymer confined in a tube was considered solved almost 30 years ago, until a measurement of the extension of DNA in nanochannels challenged these classical results in polymer physics. Moreover, emerging genomics methods that take advantage of confined DNA have provided a strong motivation for reconciling theory and experiment in this field. As a result, there are a number of simulations and experiments aimed at examining the equilibrium extension of confined DNA as a function of the channel size. While these results have shed some light on the problem, a complete theoretical description for a confined semiflexible polymer still does not exist. We will present a combination of scaling theory and simulation results using an implementation of the Pruned-Enriched Rosenbluth method (PERM) that provides such a description in terms of both the confinement free energy and the extension of very long chains. In doing so, we provide clear evidence that a Gaussian-like regime emerges for stiff chains in between the classic Odijk and de Gennes regimes. The observation of this regime leads to our key conclusion that confined, semiflexible chains are best understood in the context of a rod-to-coil transition, which is directly analogous to its bulk counterpart.

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