"Delocalization of topological entanglement in geometrically constrained polymers"

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The imposition of geometrical constraints (slip links, walls with hole, etc.) on the equilibrium configurations of a ring polymer with fixed topology are necessary for assessing the degree of localization of its knot. The issue of localization/delocalization is in turn related to important properties like the probability of realization of a given knot type or the thermodynamic differences between good and bad solvent regimes. After reviewing in particular recent results concerning knot delocalization for globular and dense chains, we will consider swollen ring polymers in a regular array of obstacles modeling confinement in a gel [1]. This system provides a remarkable example of crossover in both geometrical and topological behavior. When the radius of gyration of the ring R_G, and that of its portion containing the (prime) knot R_k are both small compared to the spacing b of the array, the knot is weakly localized, and R_G scales as in good solvent, with an amplitude depending on knot type. In the intermediate regime $R_G > b > R_k$, the geometry of the polymer becomes branched. Eventually, when R_k exceeds b, the knot delocalizes becoming also branched. In this regime R_G becomes independent of knot type. Implications of these equilibrium results for gel electrophoresis in weak fields will be discussed.

[1] E. Orlandini, A. L. Stella, C. Vanderzande, arXiv:1004.4501v1 [cond-mat.soft] (2010).