Mathematics > Probability

Charged polymers in the attractive regime: a first order transition from Brownian scaling to four points localization

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We study a quenched charged-polymer model, introduced by Garel and Orland in 1988, that reproduces the folding/unfolding transition of biopolymers. We prove that, below the critical inverse temperature, the polymer is delocalized in the sense that: (1) The rescaled trajectory of the polymer converges to the Brownian path; and (2) The partition function remains bounded. At the critical inverse temperature, we show that the maximum time spent at points jumps discontinuously from 0 to a positive fraction of the number of monomers, in the limit as the number of monomers tends to infinity. Finally, when the critical inverse temperature is large, we prove that the polymer collapses in the sense that a large fraction of its monomers live on four adjacent positions, and its diameter grows only logarithmically with the number of the monomers. Our methods also provide some insight into the annealed phase transition and at the transition due to a pulling force; both phase transitions are shown to be discontinuous.

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