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Denaturation of Circular DNA: Supercoils, overtwist and condensation[1] ALKAN KABAKCIOGLU, Koc University, AMIR BAR, DAVID MUKAMEL, Weizmann Institute of Science — The statistical mechanics of DNA denaturation under fixed linking number is qualitatively different from that of the unconstrained DNA. Past work suggests that the nature of this constrained melting transition is sensitive to the mechanism that relaxes the torsional stress induced on the bound portions by the loops. Quantitatively different melting scenarios are reached from two alternative assumptions, namely, that the denatured loops are formed in expense of 1) overtwist, 2) supercoils. Recent work has shown that the supercoiling mechanism results in a BEC-like picture where a macroscopic loop appears at T_c and grows steadily with temperature while no such phenomenon has been reported for the overtwisting case. By extending an earlier result, we show here that a macroscopic loop appears in the overtwisting scenario as well. We calculate its size as a function of temperature and show that the fraction of the total sum of microscopic loops decreases above T_c, with a cusp at the critical point.

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Alkan Kabakcioglu
Koc University

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