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Supercoil formation in DNA denaturation ALKAN KABAKCIOGLU, Koc University, ENZO ORLANDINI, Universita di Padova, DAVID MUKAMEL, Weizmann Institute of Science — We generalize the Poland-Scheraga model to the case of a circular DNA, taking into account the winding of the two strains around each other. Guided by recent single-molecule experiments on DNA strands, we assume that the torsional stress induced by denaturation enforces the formation of supercoils whose writhe absorbs the linking number expelled by the loops. Our model predicts that when the entropy parameter of a loop satisfies $c \leq 2$, a thermodynamic denaturation transition does not exist. On the other hand, for $c > 2$, a first-order denaturation transition is consistent with our model and may take place in the actual system, as in the case with no supercoils. These results are in contrast with other treatments of melting circular DNA where denaturation is assumed to be accompanied by an increase in twist rather than writhe on the bound segments.

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