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The energetics of tightly bent DNA: a composite elastica model including local melting ARTHUR EVANS, ALEX LEVINE, UCLA Department of Chemistry and Biochemistry — Melting transitions are well-known to be affected by the application of mechanical stress. Motivated by the experiments of Zocchi and collaborators (Qu and Zocchi 2011, EPL **94** 18003), we explore the effect of the application of mechanical stress on DNA melting in a particular composite of a stiff double stranded piece of DNA (dsDNA), shorter than its own persistence length, whose ends are linked by a flexible single stranded piece of DNA (ssDNA). The flexible ssDNA acts as a Gaussian polymer coil bending the stiff dsDNA through an elastic force that is controllable by the length of the ssDNA chain. In this talk we present theoretical predictions for two experimentally accessible features: the degree of local dsDNA melting and the local elastic energy of the dsDNA/ssDNA construct both as a function of the length of the attached ssDNA. We also address the effect of introducing a nick (broken covalent bond) in the dsDNA backbone on these results and discuss the implications of such data on the relative importance of backbone elasticity versus base stacking and base pairing interactions in determining the elasticity of dsDNA. This work also addresses open questions in the nonlinear elasticity of DNA in tightly bent curves.

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