Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

The effect of local melting of DNA on DNA loop formation JIYOUN JEONG, HAROLD KIM, Georgia Inst of Tech — Statistical mechanics of double-stranded DNA (dsDNA) is well described by the wormlike chain model (WLC) which assumes a harmonic bending potential. Such smooth bending potential may no longer be valid for large bending angles to form small loops (<100 bp). Instead, DNA may rely on rare structural transitions such as local melting (opening) of base pairs to lower the energetic cost. In theory, open base pairs called bubbles can increase the looping probability of short DNA molecules by a few orders of magnitude, but a robust experimental validation of this theoretical prediction is lacking. Here, we investigated the correlation between local melting probability and looping dynamics of dsDNA using single-molecule fluorescence resonance energy transfer (FRET). We designed two groups of short DNA molecules with low and high melting probabilities around their center and measured their looping and unlooping rates in equilibrium. Our data allow rigorous tests of meltable wormlike chain (MWLC) models at short length scales for setting ranges of acceptable free energy cost of bubble formation and flexibility values of a bubble.

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Date submitted: 02 Dec 2015 Electronic form version 1.4