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Correlated local bending of DNA and its effect on DNA flexibility XINLIANG XU, Department of Chemistry, MIT; & Pillar of Engineering Product Development, SUTD, JIANSHU CAO, Department of Chemistry, MIT — The flexibility of long DNA chains can be well described by the worm-like chain model (WLC) as a semi-flexible polymer with all local details coarse grained into one parameter, the persistence length l_p (approximately 150 base pairs). Recent experimental studies of DNA in the sub persistence length regime have shown a dramatic departure from WLC and suggested a length dependent DNA flexibility. Here we report an improved model of DNA flexibility with explicit considerations of a new length scale l_D (approximately 10 base pairs), over which DNA local bend angles are correlated (arxiv.org/abs/1309.7515). In this correlated worm-like chain (C-WLC) model, a finite length correction term is analytically derived and the persistence length is found to be contour length dependent. While our model reduces to the traditional worm-like chain model when treating long DNA at length scales much larger than l_p, it predicts that DNA becomes much more flexible at shorter sizes, in good agreement with recent cyclization measurements of short DNA fragments around 100 base pairs.

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