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Analysis of conflicting experimental studies of DNA size in nanofluidic slits SAMUEL M. STAVIS, NIST/CNST, ELIZABETH A. STRYCHALSKI, NIST/MML, BRIAN J. NABLO, JON GEIST, NIST/PML —
Recent experimental studies have reported conflicting accounts of the size variation of DNA in nanofluidic slitlike confinement; [Bonthuis et al., Physical Review Letters 101, 10, 108303 (2008)], [Tang et al., Macromolecules 43, 17, 7368 (2010)], [Strychalski et al., Macromolecules 45, 3, 1602 (2012)], [Lin et al., Macromolecules 45, 6, 2920 (2012)], [Dai et al., Soft Matter 8, 10, 2972 (2012)]. In an effort to resolve this controversy, these studies are analyzed by a reductive as opposed to predictive approach. Minimum references for DNA size (baselines) are simulated by a Monte Carlo methodology and quantitatively compared to measured and inferred DNA sizes. The measurements of Tang et al., Strychalski et al., and Lin et al. are consistent with the related baselines and in semi-quantitative agreement with each other. The inferences of Tang et al. and Dai et al. are consistent with the related baseline and in qualitative agreement with the measurements of Tang et al., Strychalski et al., and Lin et al. The measurements of Bonthuis et al. are inconsistently larger than the related baseline and the other experimental measurements and inferences of DNA size around the transition from moderate to weak slitlike confinement. A variety of physical and chemical differences between the experimental systems are examined in detail to elucidate this inconsistency. Detailed analyses of the baseline distribution and variation clarify several core physical attributes of the system related to excluded volume effects and chain dimensionality.

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