Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Comparison of the Single Molecule Dynamics of Linear and Circular DNAs in Planar Extensional Flows[1] YANFEI LI, Texas Tech University, KAI-WEN HSIAO, CHRISTOPHER BROCKMAN, University of Illinois at Urbana-Champaign, DANIEL YATES, GREGORY MCKENNA, Texas Tech University, CHARLES SCHROEDER, University of Illinois at Urbana-Champaign, MICHAEL SAN FRANCISCO, Texas Tech University, JULIE KORNFIELD, California Institute of Technology, RAE ANDERSON, University of San Diego — Chain topology has a profound impact on the flow behaviors of single macromolecules [1]. The absence of free ends separates circular polymers from other chain architectures, i.e., linear, star, and branched. In the present work, we study the single chain dynamics of large circular and linear DNA molecules by comparing the relaxation dynamics, steady state coil-stretch transition, and transient molecular individualism behaviors for the two types of macromolecules. To this end, large circular DNA molecules were biologically synthesized [2] and studied in a microfluidic device that has a cross-slot geometry to develop a stagnation point extensional flow [3]. Although the relaxation time of rings scales in the same way as for the linear analog, the circular polymers show quantitatively different behaviors in the steady state extension and qualitatively different behaviors during a transient stretch. The existence of some commonality between these two topologies is proposed. [1] M. Kapnistos et al., Nat. Mater. 7, 997 (2008). [2] S. Laib et al., Macromolecules 39, 4115 (2006). [3] M. Tanyeri et al., Lab Chip 11, 1786 (2011).

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Date submitted: 03 Nov 2014 Electronic form version 1.4