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Conformational Analysis of Single DNA Molecules Undergoing Entropically Induced Motion in Nanochannels. JOHN MANNION, CHRISTIAN RECCIUS, JOSHUA CROSS, HAROLD CRAIGHEAD, Cornell University — We have used the interface between a nanochannel and a microchannel as a tool for applying controlled forces on a DNA molecule. A molecule with a radius of gyration larger than a nanochannel width, that straddles such an interface, is subject to an essentially constant entropic force which can be balanced against other forces such as the electrophoretic force from an applied electric field. By controlling the applied field, we can position the molecule as desired and observe the conformation of the molecule as it stretches, relaxes and recoils from the nanochannel. We quantify and present models for the molecular motion in response to the entropic, electrophoretic and frictional forces acting on it. By determining the magnitude of the drag coefficients for DNA molecules in the nanostructure, we are able to estimate the confinement induced recoil force. Finally, we demonstrate that we can use a controlled applied field and the electrophoretic interfacial forces to unfold molecules, which can then be manipulated and positioned in their simple extended morphology.

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