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Probing electrostatic interactions between DNA and the walls of slit-like nanofluidic channels YONGQIANG REN, Brown University, WALTER REISNER, Mcgill University, DEREK STEIN, Brown University — Recent progress in nanofluidic technology suggests the possibility of controlling single DNA molecules using purely electrostatic forces, which are influenced by the ionic strength. We studied the ionic dependence of DNA conformations in slit-like nanochannels of varying height using fluorescence video microscopy. By applying polymer scaling theory to the measured radius of gyration of individual molecules, we inferred the electrostatic interaction between the negatively charged DNA and the negatively charged channel walls. With decreasing ionic strength, the excluded region near the channel wall showed an abrupt saturation around ∼1mM that was not anticipated by existing theories. We can explain our observations by considering the DNA segments as multivalent ions which strongly influence the local ionic strength, and hence the electrostatic screening length. These results allow us to predict the magnitude and range of the electrostatic forces that can be exerted on confined DNA molecules using the electro-fluidic field effect.

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