Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Measuring DNA Confinement and Excluded Volume Parameters: Scaling with confinement and ionic strength ALEXANDER KLOTZ, LYNDON DUONG, LAURENCE COURSOL, WALTER REISNER, McGill University — Using nanofluidic devices for genomic mapping requires an understanding of the underlying polymer physics of confined DNA. Despite many years of study, there are still aspects that are poorly understood, including the role that excluded volume and semiflexibility play under confinement. Here, a hybrid nanofluidic device consisting of a narrow slit embedded with a lattice of square pits was used to study confined DNA. At equilibrium, molecules tend to occupy one or more pits. The partitioning of molecular contour between the pits and the slit is dependent on maximizing entropy by removing contour from the highly confining slit while reducing excess free energy due to excluded volume interactions from increased concentration in the pit. Measurements of the average number of occupied pits as a function of pit dimension, slit height, and ionic strength serves as a probe of the underlying polymer physics. In particular, the free energy of slit-like confinement and the effective molecular width were measured across a range of slit heights and ionic strengths. It was found that effective width scales with ionic strength according to Stigter's charged rod theory, and that the Chen-Sullivan interpolation formula for the slit-like energy of confinement describes the data well for narrow slits. Unexpected scaling of the confinement free energy with ionic strength indicates that excluded volume effects are relevant for confined DNA.

Alexander Klotz
McGill University

Date submitted: 04 Nov 2013

Electronic form version 1.4