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DNA translocation through nanopores: effect of salt concentration SANDIP GHOSAL, Northwestern University — Recent experiments on the detection of single molecules of linear polyelectrolytes through nanopores could lead to an ultrafast and inexpensive method of rapidly sequencing linear polymer chains such as DNA and RNA. In earlier work (see Ghosal, S. in APS DFD06 abstracts) a hydrodynamic model for determining the electrophoretic speed of a polyelectrolyte through an axially symmetric slowly varying nanopore was presented in the limit of vanishingly small Debye length. Here the case of a finite Debye layer thickness is considered within the Debye-Hückel and Stokes flow approximations while restricting the pore geometry to that of a cylinder of length much larger than the diameter. Further, the possibility of a uniform surface charge on the walls of the nanopore is taken into account. The model admits an exact analytical solution from which translocation times are calculated and found to be consistent with recent measurements in solidstate nanopores. It is suggested, based on the solution to the model problem, that the translocation speed can be greatly reduced if the ζ -potential of the nanopore walls could be fine tuned to match closely the ζ -potential of the polyelectrolyte. Physically this amounts to balancing the net electrical force on the polyelectrolyte inside the pore by the viscous drag of the electroosmotic flow inside the nanopore. Reduction of the translocation speed by several orders of magnitude is essential for achieving single base resolution.

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