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fd Virus as a Model Stiff Polymer for Translocation Experiments with Solid-State Nanopores[1] ANGUS MCMULLEN, XU LIU, MIRNA MIHOVILOVIC, DEREK STEIN, JAY TANG, Brown University — We report preliminary experimental results of the translocation of the filamentous virus fd through a solid-state nanopore. fd virus is suitable for translocation and detection in a voltage-biased nanopore because it is highly charged, 880 nm long, and 6.6 nm in diameter. Importantly, fd has a persistence length of $\sim$2 μm, a forty-fold increase over ds-DNA, making fd a model stiff polymer for testing theories of polymer translocation dynamics. fd cannot coil in solution, therefore the dispersion of fd translocation times can test a model by Lu et al. that ascribes DNA translocation velocity fluctuations to the distribution of initial conformations of the DNA coil. That picture is in contrast with an alternative model by Li et al., which attributes the spread of DNA translocation times to thermal velocity fluctuations. The physics of fd capture by a nanopore also differs significantly from DNA since the ends of the virus cannot diffusively search for the pore independently of the middle. As a result, the rate of fd capture from solution may not increase monotonically with the applied voltage across the pore; it is possible for fd to become kinetically trapped against the nanopore membrane by the electric field. We will compare the distribution of translocation times of fd virus to distributions for DNA and discuss the influence of the virus's orientation and interactions with the nanopore on the translocation speed and the measured current blockage. We will also examine the dependence of capture rate on the applied voltage.

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