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Nonlinear transport of fd virus particles through a solid-state nanopore

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In this talk I will discuss our recent experiments on fd virus particles. The fd particles provide an interesting model system for testing the first-passage time theory of electric-field-driven translocation. We find that the distribution of translocation time can be understood using Schrodinger's first-passage time distribution function. The extracted diffusion constant for fd is significantly larger than the expected value from the Stokes-Einstein relation. We also find that the extracted translocation velocity is a nonlinear function of the electric field. We attribute the large effective diffusion constant to a Taylor dispersion effect in the electroosmotic flow profile in the nanopore and the nonlinear electrophoretic mobility to a Stotz-Wien effect.