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Detecting Single DNA and Proteins Using a Solid-state Nanopore Device

JIALI LI, Physics Department, University of Arkansas, Fayetteville, AR72701

Charged single proteins and DNA molecules can be detected as they are driven through a solid-state nanopore by an applied electric field. The solid-state nanopores are fabricated in a free standing silicon nitride membrane using low energy noble gas ion beams. We demonstrate the silicon nitride nanopore based sensor can measure the properties of single molecules of proteins, double stranded DNA, and single stranded DNA molecules at different temperature, pH, and ionic strength. This technique allows us to discriminate between different types of molecules, different conformations of the same molecules, and also determine the configuration of individual molecules as well as their configuration distribution. We demonstrate the silicon nitride nanopore sensing system is robust and capable of detecting structural information of protein and DNA at extreme conditions.