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Trapping Single Molecules With a Solid State Nanopore MARC GERSHOW, DAVID HOOGERHEIDE, Harvard University Dept. of Physics, ERIC BRANDIN, Harvard University Dept. of Molecular and Cellular Biology, JENE GOLOVCHENKO, Harvard University Dept. of Physics and School of Engineering and Applied Sciences — We demonstrate a single molecule trap based on a solid state nanopore. A single molecule of DNA is driven through a nanopore by an applied eletric field. The passage of the molecule through the nanopore is detected by a decrease in the ionic current through the pore. After the molecule has passed through the pore, we reverse the applied field to recapture the molecule and drive it through the pore again. Upon detection of this second passage, we again reverse the applied field, leading to a third passage through the pore, and so on. Thus the molecule is continually confined by a $\frac{1}{r}$ potential maintained by active feedback. Upon each passage through the pore, the state of the molecule is electronically interrogated via the measured current blockage. Molecules can be trapped, detected, and analyzed in free solution without any labels or chemical modifications. Repeated electronic interrogation of a single molecule provides a means for greatly enhancing the accuracy with which each molecule can be characterized by a nanopore and allows measurement over time of dynamical properties such as the molecule's conformation and chemical state.

Marc Gershow
Harvard University Dept. of Physics

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