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Calcium Induced Voltage Gating and Negative Incremental Resistance in Single Conical Nanopores. ZUZANNA SIWY, MATTHEW POWELL, University of California, Irvine, MICHAEL SULLIVAN, George Mason University, CHRISTINA TRAUTMANN, Gesellschaft fuer Schwerionenforschung, ROBERT EISENBERG, Rush Medical College — We will present a nanopore device working in an ionic solution that has transport characteristics similar to unijunction transistors working in electronic circuits, namely negative incremental resistance and voltage dependent ion current fluctuations. Our device consists of a single conical nanopore in solutions containing potassium chloride and sub-millimolar concentrations of calcium and cobalt ions. I will talk about importance of electrostatic and chemical interactions of translocating ions with pore walls. We explain the transport effects on the basis of transient binding of calcium ions to chemical groups on the pore walls that cause transient changes in electric potential inside a conical nanopore. Possibilities of constructing a chemical oscillator with tens of Hz operating frequency will be presented as well. We will also discuss application of this oscillating system to building a synthetic stochastic sensor. Since the system operates far from equilibrium, we expect it to be very sensitive to any changes/perturbations, e.g. presence of molecules that we want to detect. The mechanism of detection strongly suggests that the sensor will respond to a whole variety of organic molecules with little modification.

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