Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Controlling the Motion of Knotted Polymers through Nanopores
VIVEK NARSIMHAN, C. BENJAMIN RENNER[1], PATRICK DOYLE, Massachusetts Inst of Tech-MIT — Nanopore sequencing is a technique where DNA moves through a pore and base-pair information is read along the chain as an electric signal. One hurdle facing this technique is that DNA passes too quickly through the pore, rendering the signal to be too noisy. In this talk, we discuss one strategy to control the speed by which polymers move through pores. By tying a knot on a polymer chain, we find that we can jam the polymer at the pore's entrance and halt translocation completely. This idea by itself may not seem useful, but by cycling the field on and off at the relaxation time scale of the knot, we can control the swelling dynamics of the knot at the pore's entrance, and hence ratchet the polymer through the pore. This talk focuses on two parts. First, we will discuss the dynamics of a knot jamming at the pore entrance and determine what sets the critical tension to halt translocation. We will determine how knot topology affects these results and discuss what regimes lead to large fluctuations in the translocation speed. We will then discuss the dynamics of a knot under a time-dependent, periodic force. Lastly, we develop a model to describe the knot's swelling dynamics during relaxation, and use this to explain some of the trends observed in our simulations.

[1]Now at Liquiglide

Vivek Narsimhan
Massachusetts Inst of Tech-MIT

Date submitted: 04 Nov 2015 Electronic form version 1.4