Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Quantitative analysis of tethered particle motion PHILIP NELSON, Dept. of Physics, Univ. Pennsylvania, CHIARA ZURLA, Dept. of Biology, Univ. Milan, DARREN SEGALL, Div. of Engr. and Applied Science, Caltech, DORIANO BROGIOLI, Dept. of Biology, Univ. Milan, ROB PHILLIPS, Div. of Engr. and Applied Science, Caltech, DAVID DUNLAP, Dept. of Cell Biology, Emory Univ., LAURA FINZI, Dept. of Physics, Emory Univ. — Tethered particle motion (TPM) is a single-molecule technique that consists in tethering a bead to a slide through a DNA molecule. The Brownian amplitude of motion of the bead provides information about the conformational changes of the DNA molecule. We describe an improved experimental protocol, and a data analysis algorithm to extract quantitative conclusions from the data. We then apply a theoretical model for the statistics of the bead motion, which are quite different from those of a free polymer. Our experimental data for chain extension versus tether length are in good agreement with the model, showing that TPM is a useful tool for monitoring large conformational changes such as DNA looping. Moreover, we present the first experimental determination of the full probability distribution function of bead displacements, and find excellent agreement with theory over a range of tether lengths. Knowing this distribution a priori enhances our ability to extract events such as loop formation from observed time series.

Philip Nelson
University of Pennsylvania

Date submitted: 29 Nov 2005 Electronic form version 1.4