Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Experimental Investigation of the Velocity Convergence of Jarzynski's Equality Using Single-Molecule AFM Pulling of Titin I27
NOLAN HARRIS, CHING-HWA KIANG, Rice University, Physics and Astronomy Department, Houston, TX 77005 — Single molecule atomic force microscopy (AFM) of individual biomolecules allows one to observe high energy conformations and transitions between equilibrium states that are not otherwise observable. Jarzynski's equality has been used to extract important equilibrium information, such as free energy surfaces, from these nonequilibrium AFM measurements. However, the convergence behavior of Jarzynski's equality, i.e. the number of AFM trajectories required to adequately sample the nonequilibrium work distribution of a process, depends nontrivially on the AFM pulling schedule. Here we study the velocity dependent nature of Jarzynski's equality in AFM experiments. We reconstructed the free energy surfaces for the forced unfolding of the I27 domain of human cardiac titin via AFM using different pulling velocities. We found that the number of experimental trajectories required for convergence of Jarzynski's equality increases roughly exponentially as experimental pulling velocity is increased. We suggest optimal pulling velocities for pulling titin I27 and discuss the obstacles involved with using extreme pulling velocities.

Ching-Hwa Kiang
Rice University, Physics and Astronomy Department, Houston, TX 77005

Date submitted: 21 Nov 2008 Electronic form version 1.4