Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Determination of effective correlation length in a glassy polymer using electrostatic force microscopy BRANT RUMBERGER, NATHAN ISRAELOFF, Northeastern University — Various fourth-order correlation functions have been used to study the size of dynamically correlated regions in colloidal glasses and simulated glass forming liquids or polymers. However, measuring these correlation functions in molecular glasses has been limited by the small length scales on which the dynamics occur. Electrostatic force microscopy techniques are employed here to probe dielectric noise in polyvinyl acetate. We analyze fourth-order statistical fluctuations in order to determine spatio-temporal correlation lengths and their temperature dependence near the sample's glass transition. The first harmonic response of an applied AC voltage between the conducting AFM tip and the conducting substrate beneath the thin film polymer sample is proportional to the local electric polarization. Noise in this signal is examined and many hours are recorded at various temperatures in order to improve statistical precision. We employ a variety of statistical analysis techniques ranging from power spectrum analysis to variance of autocorrelation functions in order to find deviations from Gaussian statistics. Super-sharp carbon nanotube EFM tips (nominal radius of 10 nm) are employed to probe smaller effective volumes and thus more easily detect these fluctuations.

Nathan Israeloff
Northeastern University

Date submitted: 10 Nov 2011 Electronic form version 1.4