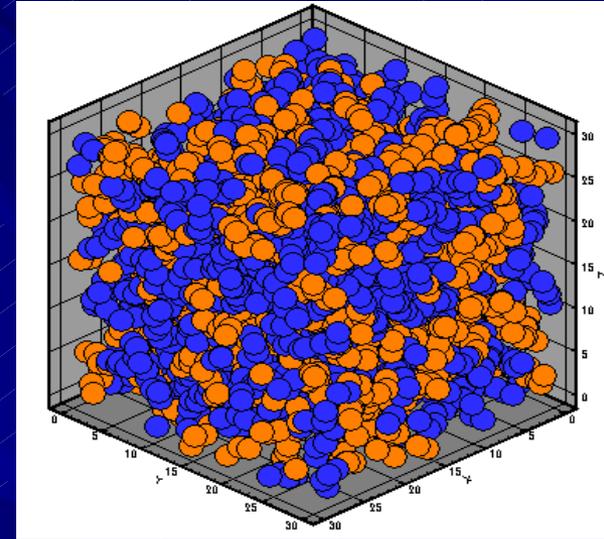


# Nanodynamics of Polymers and Polymer Blends

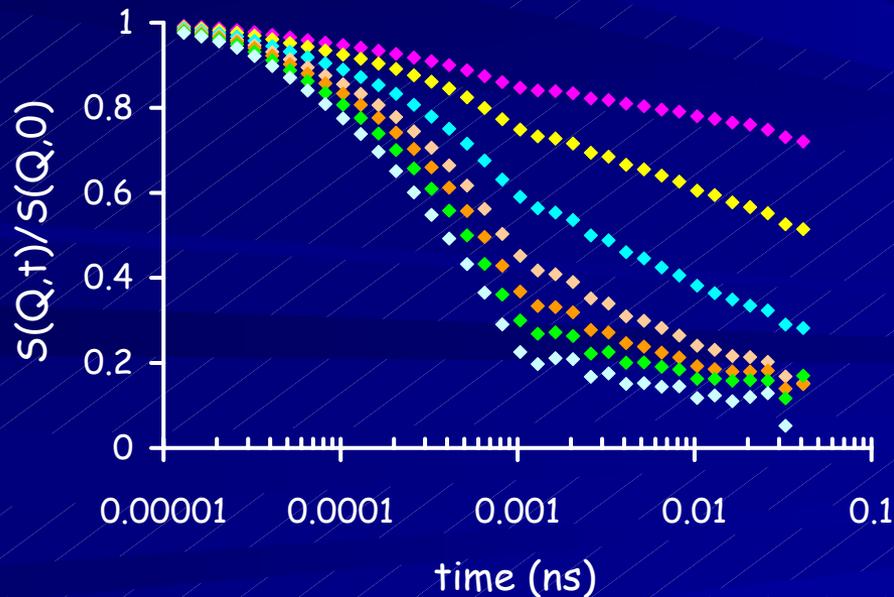
Janna K. Maranas, Penn State University

DMR 0134910

Our understanding of nanoscale structure has exploded in recent years. The next step is nanoscale dynamics. Molecular mobility over nanosecond time scales and nanometer length scales controls important phenomena – examples include the on/off process in molecular switches and recognition of proteins by binding sites. In polymer science, these motions underlie the glass transition, one of the most important physical properties. Our NSF supported work investigates nanodynamics using neutron scattering in combination with molecular simulation – both of which provide nanoscale resolution in time and space.



Simulation results showing a snapshot of molecular positions in a polymer blend. The technique allows for easy visualization of molecular motion.



Characterization of mobility using neutron scattering. The different curves represent motion over a series of spatial scales from 3-11 Å and illustrate the spatial resolution of the technique.

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**Education:** Chemical engineering education at the undergraduate level is typically a macroscopic endeavor. We are bringing the molecular level research in the Maranas group to the Penn State undergraduate population – by introducing “experiments” in molecular simulation as projects in courses, and as part of the required laboratory course.



*Undergraduates in the Maranas group examine a vacuum line used for polymerization reactions.*

## **Research opportunities for undergraduates:**

Undergraduate students at non-research institutions often do not have the opportunity to become exposed to research. The Maranas group, with support from NSF, sponsors students from the chemical engineering department at Cal Poly Pomona to spend a summer doing research at Penn State as part of their senior thesis.



*Maranas group graduate students supported by NSF.*