Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Competing dynamic phases of active polymer networks[1] SIMON FREEDMAN, Univ of Chicago, SHILADITYA BANERJEE, AARON R. DINNER, James Franck Institute, Univ of Chicago — Recent experiments on in-vitro reconstituted assemblies of F-actin, myosin-II motors, and cross-linking proteins show that tuning local network properties can changes the fundamental biomechanical behavior of the system. For example, by varying cross-linker density and actin bundle rigidity, one can switch between contractile networks useful for reshaping cells, polarity sorted networks ideal for directed molecular transport, and frustrated networks with robust structural properties. To efficiently investigate the dynamic phases of actomyosin networks, we developed a coarse grained non-equilibrium molecular dynamics simulation of model semiflexible filaments, molecular motors, and cross-linkers with phenomenologically defined interactions. The simulation's accuracy was verified by benchmarking the mechanical properties of its individual components and collective behavior against experimental results at the molecular and network scales. By adjusting the model's parameters, we can reproduce the qualitative phases observed in experiment and predict the protein characteristics where phase crossovers could occur in collective network dynamics. Our model provides a framework for understanding cells' multiple uses of actomyosin networks and their applicability in materials research.

[1]Supported by the Department of Defense (DoD) through the National Defense Science Engineering Graduate Fellowship (NDSEG) Program.

Simon Freedman
Univ of Chicago

Date submitted: 06 Nov 2015 Electronic form version 1.4