Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Polydispersity in semiflexible networks: Implications for mechanics of the cytoskeleton MO BAI, UCLA, ANDREW MISSEL, WILLIAM KLUG, ALEX LEVINE — Semiflexible networks admit a nonaffine-to-affine (A/NA) crossover – an abrupt transition with increasing crosslink density from a soft, bending-dominated nonaffine network to a stiffer affine network in which elastic energy is stored primarily in stretching. Studies have shown that there is a single control parameter determining the network's affinity: the ratio of the length of a constituent filament to the so- called nonaffinity length, which is a function of both the mechanical moduli of the filaments and the density of the network. This result suggests important questions regarding the A/NA crossover in heterogeneous networks. We extend the previous analysis to two classes of heterogeneous networks by considering: (i) length polydispersity, and (ii) mechanical heterogeneity, using networks composed of stiffer and more compliant filaments. Both systems have direct implications to the mechanics of living cells. We show that the addition of a small fraction of longer and stiffer filaments to a nonaffine network leads to significant increases in its elastic moduli even when the stiffer filaments are at such a low density so as to not form a stress bearing network. We present a new A/NA phase diagram for networks composed of filaments of two lengths and present results for the mechanics of networks having a continuous distribution of filament lengths, similar to those found in in vitro F-actin experiments.

Mo Bai
UCLA

Date submitted: 20 Nov 2009 Electronic form version 1.4