Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Bond-breaking in semiflexible networks and the peeling dynamics of a filament from a random array of pinning sites CHRISTIAN VACA, ALEX J. LEVINE, Univ of California - Los Angeles — Recent rheological experiments on cross-linked microtubule networks suggest that the principal dissipative mechanism at low frequencies is cross linker breakage. In such networks, applied stress leads to both the breaking of old cross links and the formation of new ones, allowing the network to maintain its elastic modulus while dissipating energy. We present a model of the underlying microscopic processes in such networks: the force-induced unbinding of a semiflexible filament from an array of randomly distributed pinning sites. These pinning sites dissociate from the filament with a force-dependent rate, as prescribed by e.g., the Bell model. This problem is part of a larger class of nonequilibrium systems that includes the driven motion of three phase contact lines and flux lines in superconductors, in which an elastic object is pulled through a quenched random potential. Using transfer matrix methods and numerical simulations, we explore the distribution of forces on the various pinning sites, and calculate the statistical properties of the filament's peeling dynamics under a constant force applied at one point perpendicular to its length. The mean peeling rate depends on the filament's bending modulus, the elasticity of the pinning sites, and their spatial distribution.

Christian Vaca
Univ of California - Los Angeles

Date submitted: 15 Nov 2013 Electronic form version 1.4