DFD09-2009-020021

Abstract for an Invited Paper
for the DFD09 Meeting of
the American Physical Society

Active Gels and Cell Quakes: Exploring the non-equilibrium rheology and fluctuation spectrum of motor-driven polymer networks

ALEX LEVINE[1], University of California, Los Angeles

Recent experiments on molecular motor driven in vitro F-Actin networks have found anomalously large strain ?uctuations at low frequency. In addition, the shear modulus of these active networks becomes as much as one hundred times larger than that of the same system in equilibrium. In this talk we develop a theory of both these phenomena using a two-?uid model of a low-density isotropic semi?exible network driven by molecular motors. Relying on only simple assumptions regarding the motor activity in the system, we find that we can quantitatively understand both the low-frequency ?uctuation enhancement and the nonequilibrium stiffening of the network. We also show the results of new numerical studies of semiflexible networks driven by molecular motors that explore the effects of high motor density in isotropic networks and the effect of nematic order in the active filament network. These results have implications for the interpretation of microrheology in such active networks including the cytoskeleton of living cells. In addition, they may form the basis for theoretical studies of biomimetic nonequilibrium gels whose mechanical properties are tunable through the control of their nonequilibrium steady-state.

[1]In collaboration with: F.C. MacKintosh (Department of Physics and Astronomy, Vrije Universiteit)