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Non-equilibrium mechanics of motor-driven cytoskeletal polymer networks

CHRISTOPH SCHMIDT, Georg-August-Universität, Fakultät für Physik, III. Physikalisches Institut

Cells both actively generate and sensitively react to forces using their mechanical framework, the cytoskeleton, which is a non-equilibrium, composite material including polymers and motor proteins. We have measured the dynamics and mechanical properties of a simple three-component model system, consisting of myosin II, actin filaments, and crosslinkers. Stresses arising from motor activity control network mechanics: both increasing stiffness by a factor of nearly 100 and qualitatively changing the viscoleastic response of the network in an ATP-dependent manner. We have quantified the mechanical properties as well as the active fluctuations in these networks by a combination of passive and active microrheology.