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Broken Detailed Balance of Filament Dynamics in Active Networks . CHRISTOPH F. SCHMIDT, Georg-August-Universitaet Goettingen, JANNES GLADROW, Georg-August-Universitt Gttingen, NIKTA FAKHRI, Massachusetts Institute of Technology, FRED C. MACKINTOSH, Rice University, CHASE BROEDERSZ, Ludwig-Maximilians-Universitt Munchen — Endogenous embedded semiflexible filaments such as microtubules, or added filaments such as single- walled carbon nanotubes can be used as novel tools to noninvasively track equilibrium and nonequilibrium fluctuations in biopolymer networks. We analytically calculated shape fluctuations of semi- flexible probe filaments in a viscoelastic environment, driven out of equilibrium by motor activity. Transverse bending fluctuations of the probe filaments can be decomposed into dynamic normal modes. We find that these modes no longer evolve independently under non-equilibrium driving. This effective mode coupling results in nonzero circulatory currents in a conformational phase space, reflecting a violation of detailed balance. We present predictions for the characteristic frequencies associated with these currents and investigate how the temporal signatures of motor activity determine mode correlations, which we find to be consistent with recent experiments on microtubules embedded in cytoskeletal networks.

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