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**Broken detailed balance in active fluctuations of semiflexible filaments** JANNES GLADROW, Georg-August University of Göttingen, Germany, NIKTA FAKHRI, MIT, FRED C. MACKINTOSH, Vrije Universiteit, Netherlands, CHRISTOPH F. SCHMIDT, Georg-August University of Göttingen, Germany, CHASE P. BROEDERSZ, Princeton University — Non-equilibrium microscopic force generation in cells often results in stochastic steady-state fluctuations. In the cell cytoskeleton, for example, cytoplasmic myosins can drive vigorous conformational fluctuations of actin filaments and microtubules. We here present an analytical and numerical analysis of randomly driven shape fluctuations of semiflexible filaments in a viscoelastic environment. To detect and quantify non-equilibrium dynamics, we focus on the breaking of detailed balance in a conformational phase space subtended by eigenmodes of the beam equation. Molecular dynamics simulations reveal a non-zero circulatory flux in phase space induced by motor activity. Furthermore, we derived an analytical expression of nonequilibrium mode correlations that allows us to predict temporal effects of active molecular motors.

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