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Detection of Non-Equilibrium Fluctuations in Active Gels[1]
ALEXANDRU BACANU, Massachusetts Institute of Technology, USA, CHASE BROEDERSZ, Ludwig-Maximilians-University of Munich, Germany, JANNES GLADROW, Georg-August University of Goettingen, Germany, FRED MACKINTOSH, Vrije Universiteit, Netherlands, CHRISTOPH SCHMIDT, Georg-August University of Goettingen, Germany, NIKTA FAKHRI, Massachusetts Institute of Technology, USA — Active force generation at the molecular scale in cells can result in stochastic non-equilibrium dynamics on mesoscpopic scales. Molecular motors such as myosin can drive steady-state stress fluctuations in cytoskeletal networks. Here, we present a non-invasive technique to probe non-equilibrium fluctuations in an active gel using single-walled carbon nanotubes (SWNTs). SWNTs are semiflexible polymers with intrinsic fluorescence in the near infrared. Both thermal and active motor-induced forces in the network induce transverse fluctuations of SWNTs. We demonstrate that active driven shape fluctuations of the SWNTs exhibit dynamics that reflect the non-equilibrium activity, in particular the emergence of correlations between the bending modes. We discuss the observation of breaking of detailed balance in this configurational space of the SWNT probes.

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Alexandru Bacanu
Massachusetts Inst of Tech-MIT

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