Fritz-Haber-Institut der Max-Planck-Gesellschaft, Humboldt-Universität zu Berlin, Max-Delbrück-Centrum für Molekulare Medizin, Otto-von-Guericke-Universität Magdeburg, Physikalisch-Technische Bundesanstalt, Technische Universität Berlin, Universität Potsdam

Berlin Center for Studies of Complex Chemical Systems

Seminar

Complex Nonlinear Processes in Chemistry and Biology

Honorary Chairman: G. Ertl
Organizers: M. Bär, C. Beta, H. Engel, M. Falcke, M. J. B. Hauser, J. Kurths, A. S. Mikhailov, P. Plath, L. Schimansky-Geier, and H. Stark

Friday, February 6, 2015, at 16:00
Address: Richard-Willstätter-Haus, Faradayweg 10, 14195 Berlin, U-Bahnhof Thielplatz (U3)

Dr. Tetsuya Hiraiwa
Department of Physics, Freie Universität Berlin

Theory on mechanics of an actin cytoskeletal network

I will talk about mechanics of a cortical cytoskeleton, which is a network consisting of actin filaments and crosslinker proteins located underneath the cell membrane. Mechanical properties of such a cortical cytoskeleton govern the cell‘s elastic and viscous resistances to deformation, which are crucial for wide variety of cellular functions. Also, myosin motor-induced stress in a cortical cytoskeleton plays crucial roles in dynamic cellular behaviors, such as cytokinesis and cell migration.
In the talk, I will explain my theoretical works on such mechanics of actin cytoskeletal networks. Firstly, I would like to present a new theoretical method to evaluate linear viscoelasticity of a filamentous network like a cytoskeleton. Using the method, we can explain a robust power-law with respect to the frequency in complex moduli, which is also observed in numerical simulations and experiments. Secondly, I plan to present a mechanical model of motor-induced stress in an F-actin network with crosslinkers, and share with you our results on motor-induced intrinsic contractility. In particular, since a cortical cytoskeleton in a living cell shows hydrodynamic characteristics, we consider the fluidic network in which there are few amount of crosslinkers and/or the crosslinkers can undergo turnover.

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