Theoretisch-Physikalisches Kolloquium

UNIVERSITÄT DES SAARLANDES

Theoretische Physik

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"Understanding cells as an active material"

Cells are an active material running on biochemical fuel (such as ATP) which keeps them systematically in an out-of-equilibrium state. The cytoskeleton is a subcellular structure consisting of protein polymer meshworks that are subject to dynamic turnover due to polymerization and depolymerization processes. I will discuss how active dynamics of a reaction-diffusion-type gives rise to structure formation and polarization in the cytoskeleton of bacteria, thus showing that cells exploit Turing-like patterns for the conductance of physiological processes.
In a second part, I will present theoretical and experimental work on the material properties of the cytoskeleton in animal cells. There, the cytoskeleton is the major determinant of cellular material stiffness and mechanical integrity. In contrast to inanimate matter, two classes of the eukaryotic cytoskeleton (actin and microtubule networks) contain active intrinsic force generators, so-called molecular motors, that lead to the generation of contractile prestress. I will show that cells exploit dynamic regulation of this active prestress to induce dynamic shape changes during the cell cycle. Furthermore, I will present measurements of the rheology of the active mitotic actin cytoskeleton and its dependence on contractile prestress. Notably, I will show that cell mechanics in mitosis is captured by a simple rheological model characterized by a slowest relaxation time scale on the order of 10 seconds which marks the onset of fluidity in the system.

Dienstag, den 02.05.2017
um 14 Uhr

Gebäude E 2 6, Seminarraum E. 04

Interessenten sind herzlich eingeladen

Der Gast wird betreut von Herrn Prof. Santen

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