



Ben-Gurion University of the Negev
Blaustein Institutes for Desert Research
The Swiss Institute for Dryland Environmental and Energy Research
Alexandre Yersin Department of Solar Energy and Environmental Physics

Title:

Cellular Mechanosensitivity in Driven Systems

Speaker:

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Abstract:

The ability of living cells to sense the mechanical properties of their microenvironment and to respond to dynamic forces is playing a central role in regulating their structure, function and fate. Yet, the precise nature of the principles and processes underlying this crucial cellular mechanosensitivity remains a fundamental open problem. Here we experimentally and theoretically address cellular sensitivity and response to two-dimensional periodic driving forces mimicking vital physiological conditions such as heart beating, pulsating blood vessels and breathing. Novel experiments of unprecedented accuracy reveal that under these conditions adherent cells continuously reorient to loading-dependent angles. A macroscopic predictive theory is developed and is shown to be in excellent quantitative agreement with individual cells orientational dynamics over a wide range of experimental conditions. The new theory, which is based on basic principles of nonequilibrium continuum physics (e.g. configurational forces and dissipation inequalities), elucidates the interplay between active and passive – as well as between irreversible and reversible – processes. It also highlights the importance of cells elastic anisotropy, dimensionality and time-scale separation for cellular mechanosensitivity. Biological and theoretical implications are briefly discussed, along with potential applications, e.g. in tissue engineering.

Tuesday, March 21, 2017, 11:00
Lecture room, Physics Building (ground floor)