PHD SEMINAR

02/06/2017 - 16H - CONF ROOM

Nilankur Dutta: Towards a Mechanical Model for Myosin Pulsations in Development

It is a well known fact that the oscillations of the actin-myosin network play a crucial role in the morphogenesis of embryos. Using fluorescence studies of myosin for the dorsal closure process in Drosophila embryo, we aim to answer key questions about myosin dynamics and forces acting in vivo. For instance, it is observed that the cycles of cell strain and that of myosin density in the cell apical surface are out of phase with each other, but a suitable physical explanation for this is not yet known.

To this end, we propose a contractility-driven physical model of the cellular cytoskeleton based on the binding and unbinding dynamics of the myosin at the apical surface. Motivated by biological knowledge from experiments we divide the myosin contained in the cell into various pools: the apex, the lateral sides and the bulk volume and consider the advection of myosin along the cell apex and the lateral boundaries. For a first approach, the binding and unbinding behaviour is assumed to mimic adsorption-desorption dynamics through Langmuir's Kinetic Laws. During the course of our research we investigate how the fluctuations in cell-shapes are driven by the concentration of acto-myosin in the cortex, and the relative interplay between the two.

In my presentation, I will talk about the trails and tribulations of modelling such a visco-elastic system via a Discontinous Galerkin FEM model, and present some insights from recent literature about how tissue or organism shape can influence the relative distribution of the Acto-Myosin cortex inside individual cells.

Marvin Brun-Cosme-Bruny

The microalga Chlamydomonas Reinhardtii is used here as a model microswimmer to study the effect of complex environments on its swimming. Its motion can be modeled by a persistant random walk where we can extract an analogous diffusion coefficient. In our experiments, we model a complex medium by a series of microfabricated pillars. Their diffusivity is analysed by means of particle tracking. Relevant statistical observables allowed us to quantify the bias involved by the presence of pillars as a function of pillars density. Particularly, as the interpillar-distance is shortened, the mean correlation time of direction gets shorter, so does the diffusion coefficient. This provides the first bases of understanding on active matter in complex environments.