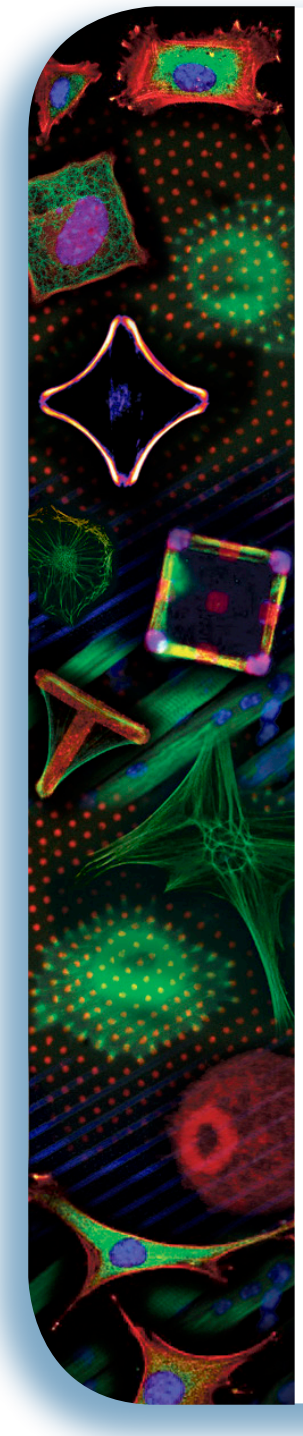

As part of our "Nano & Micro-Systems for Cell Biology" seminar series,

we are delighted to invite you to attend this seminar to be given in english by :

Andrea PARMEGGIANI

Université de Montpellier II
Biological Physics and Systems Biology
Complex Systems and Non Linear Phenomena

Friday 4 April 2014
2pm

Exclusion processes on networks as models for cytoskeletal transport and intracellular traffic

Amphithéâtre M001
Grenoble INP - Ecole Phelma MINATEC
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Exclusion processes on networks as models for cytoskeletal transport and intracellular traffic

Biological cells require active fluxes of matter to maintain their internal organization and operate multiple tasks to live. They indeed heavily rely on cytoskeletal transport driven by motor proteins fueled by ATP hydrolysis for delivering vesicles and biochemically active cargos within the cell. Experimental progress allow nowadays quantitative studies describing intracellular transport phenomena down to the nanometric scale of single molecules. Theoretical approaches face therefore at the challenge of modeling the multiscale, off-equilibrium and non linear properties of cytoskeletal transport: from the mechanochemical complexity of a single molecular motor up to the description of motor protein collective transport on the scales of the whole cell.

One approach to obtain fundamental insights into collective mechanisms and provide predictions for experimental situations is to use non-equilibrium statistical mechanics transport models. I will illustrate our recent progress in building a very general modeling scheme for cytoskeletal transport based on lattice gas models, called "Exclusion Processes", on networks. These are indeed known to be good candidates for understanding how collective and non-equilibrium effects of large clusters of motors arise from the molecular properties of single motors. I will identify general mechanisms by how matter concentration heterogeneities build up in the cell by cytoskeletal transport, via an interplay between the cytoskeleton topology and the molecular properties of individual motors. The model versatility and recent in-vitro studies suggest the concrete possibility of implementing such an approach to experimental tests.

Last but not least, the understanding of non-linear transport processes on complex networks inspired by this study can also provide hints of great interest for fundamental and applied sciences not necessarily related to the biological realm. Examples considered show that our approach is indeed general, and could thus prove interesting for a large variety of transport processes, such as vehicular, pedestrian and data traffic, or ultimately for technological and biomedical applications.

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