UNIVERSITÉ DU LUXEMBOURG

Physics Colloquium

10th of October 2019 at 4.00 pm
Coffee at 3.45 pm

Campus Limpertsberg

Bâtiment des Sciences –room BS 0.04

Talk by Prof. Dmitry Fedosov
Institute of Complex Systems, Forschungszentrum Juelich, Germany
Invited by Physics Research unit.

Non-equilibrium processes in biosystems: active membrane fluctuations and the formation of cell aggregates

Biological systems generally rely on various active (non-equilibrium) processes to perform their vital functions. Examples include homeostasis, cell migration and adhesion, and the formation of cellular aggregates. The main goal of our research is to understand and describe the physical mechanisms which govern different biological processes, and link them to relevant biological functions. For this purpose, we employ numerical simulations and analytical modelling. In this talk, I will give a few examples from our research concerning non-equilibrium processes in biological systems. First, I will show non-equilibrium membrane fluctuations of a red blood cell, which may result from the interactions between a lipid membrane and the cell's cytoskeleton as well as from the activity of intramembrane pumps. The second example will illustrate sculpting of fluid vesicles by active self-propelled particles from inside out. Finally, I will discuss aggregation of platelets and the highly adhesive protein von Willebrand factor (VWF) in the hemostatic process (i.e. blood clotting).

Biography: Dmitry Fedosov received his Bachelor's degree in mathematics from Novosibirsk State University, Novosibirsk, Russia in 2002. After earning a MS degree in aerospace engineering from the Pennsylvania State University in 2004, he moved to Brown University, where he pursued a PhD degree in applied mathematics. Dmitry received a MS degree in applied mathematics in 2007 and his PhD in 2010. His thesis work was on multiscale modeling of blood flow and soft matter with the focus on modeling polymers and blood cells. His thesis work was recognized with the David Gottlieb Memorial Award for excellence in graduate study by the Brown University's Division of Applied Mathematics and with the 2011 Nicholas Metropolis Award for outstanding doctoral thesis work in computational physics from the American Physical Society. After completing his PhD, Dmitry moved to Forschungszentrum Juelich, Germany for a postdoctoral position in the theoretical soft matter and biophysics group led by Gerhard Gompper. In 2012, Dmitry was awarded the Sofja Kovalevskaja Award from the Humboldt foundation to build up an independent research group at the Institute of Complex Systems, Forschungszentrum Juelich, Germany. In 2016, he obtained a Habilitation in Theoretical Physics from the Faculty of Mathematics and Natural Sciences, University of Cologne, Germany. Dmitry continues to work as a group leader at the Institute of Complex Systems, Forschungszentrum Juelich with a research focus on non-equilibrium physics, including various complex systems in biophysics, and soft and active matter.


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