

Physics Colloquium

8th of October 2019 at 9.00 am

Coffee at 8.45 am

Campus Limpertsberg

Bâtiment des Sciences –room BS 0.04

Talk by Prof. Fernando Peruani
University of Nice Sophia Antipolis
Invited by Physics Research unit.

Towards a physical understanding of bacterial infections: applying active matter to unveil how bacteria move and infect

Gastrointestinal infections occur by both, motile and non-motile pathogenic bacteria. Populations studies, where mice were infected with flagellated, pathogenic bacteria and non-flagellated mutants of these bacteria, suggest that there exists a correlation between bacterial motility and bacterial virulence. However, so far, there is no quantitative understanding of the role played by bacterial motility – if any -- in the infection process. By combining active matter theory and *in vitro* experiments with two flagellated, pathogenic bacteria -- *Escherichia coli* and *Salmonella Typhimurium*, we managed to (i) unveil how bacteria explore surfaces – which for *E. coli* results from a complex interplay between hydrodynamics and surface adhesion -- and (ii) build a quantitative infection model for the *in vitro* experiments that provides the first mechanistic explanation of the role played by bacterial motility in the infection process. Furthermore, we will see that a statistical physics perspective of bacterial infections – specifically, if we think how active particles move in complex environments -- let us conceive physical ways to prevent, or reduce the risk, of bacterial infections.

Refs:

Perez Ipina, Otte, Pontier-Bres, Czerucka, Peruani, Nature Physics 15, 610-615 (2019)

Otte, Perez Ipina, Pontier-Bres, Czerucka, Peruani, submitted (2019)

Peruani, Aranson, Phys. Rev. Lett 120, 238101 (2018)



Biography: After studying physics at the University of Buenos Aires, Argentina, I obtained a scholarship from the Max Planck Society to pursue my PhD at Max Planck Institute for the Physics of Complex Systems in Dresden, Germany. Supervised by Prof. Markus Bär and Prof. Andreas Deutsch, I obtained my doctoral degree on Theoretical Physics in 2008. Immediately after, I moved to CEA-Saclay as a postdoc where I worked with Prof. Hugues Chaté for two years. After that, I moved back to Germany for an independent postdoc position. Soon after, in 2011, I obtained a Maître de Conférences position (equivalent to lecturer/reader position) at the University of Nice Sophia Antipolis (now Université Côte d'Azur), where I teach undergraduate and graduate courses and lead a small research group on Complex Biological Systems & Active Matter.

