Eugene Wigner Colloquium

joint event of GRK 1558 and SFB 910

SFB 910

Dr. Avraham Be'er

Ben-Gurion University of the Negev

"Complex Dynamics of Collectively Swarming Bacteria"

A well-studied example of collective motion in nature is bacterial swarming, in which flagellated bacteria migrate rapidly over surfaces. Swarming is typically characterized by densely-packed groups of bacteria moving in coherent swirling patterns of whirls and flows that can persist for several seconds. There has been considerable recent progress in understanding the swarming phenomenon, including the underlying biological manifestations (such as cell elongation, increased flagellar density, secretion of wetting agents and increased antibiotic resistance), the physical interactions between cells and with the medium (such as steric and hydrodynamic interactions, and reduction of viscosity in crowded suspensions), and the statistical properties of the swarm (such as distribution of group velocities, correlations and clustering).

In this seminar I will present 3 new features in collectively moving bacteria. (1) The transition to anomalous statistics of swarming bacteria under antibiotics stress, with a heavy-tailed speed distribution and a two-step temporal correlation of velocities. The transition is due to changes in the properties of the bacterial motion that self-segregate into clusters. This phenomenon suggests a new strategy bacteria employ to fight antibiotic stress. (2) The formation of collective motion in spherical bacteria – despite weak steric interactions and past theoretical predictions. (3) Lévy walks of individual bacteria inside the dense swarm. Such processes were found to optimize searching in sparsely and randomly distributed targets in the absence of memory. The evidence of super-diffusion consistent with Lévy walks in bacteria suggests that this strategy may have evolved considerably earlier than previously thought.

GRK1558 research training group

Thursday, 15.10.15 · 16:15h · EW 202

Technische Universität Berlin · Institut für Theoretische Physik · Hardenbergstraße 36 · 10623 Berlin
www.itp.tu-berlin.de/grk1558 · www.itp.tu-berlin.de/sfb910