

Eugene Wigner Colloquium

joint event of GRK 1558 and SFB 910



Prof. Jaume Casademunt

University of Barcelona

“Hydrodynamic instabilities and weak turbulence in expanding epithelial tissues”

Collective cell migration in freely spreading epithelia in controlled environments has become a landmark in our current understanding of fundamental biophysical processes in development, regeneration, wound healing or cancer. The possibility of measuring simultaneously both local forces and velocities in model epithelial monolayers in vitro, has revealed a rich repertoire of dynamic behavior that is now amenable to quantitative modeling but still remains poorly understood. In particular, some experiments have reported the puzzling observation of apparently elastic waves when one would expect a pure viscous fluid behaviour of the tissue. Here we propose a continuum description that combines two sources of activity: traction forces on the substrate and contractile stresses. This provides a theoretical framework of epithelial monolayers that reveals new mechanical instabilities of polarized tissues generated by active stresses. The model explains a variety of experimental observations and in particular the paradoxical appearance of elastic-like waves in a viscous medium. We discuss the mechanisms that lead to pattern formation and nonlinear traveling waves. Through the derivation of a Complex Ginzburg-Landau equation, we discuss the transition to spatio-temporal chaos and we speculate on the nature of the apparent turbulent behavior observed in epithelial tissues, in the context of other examples of active turbulence.

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GRK1558
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