



UNIVERSITY
OF TRENTO - Italy
Department of Physics

Prof. Dr. Erwin Frey

Chair of Theoretical Physics - Ludwig-Maximilians-Universität München

2025, December 10 – 2:00 p.m., Room A204 – Polo Ferrari 1

Emergence and Self-Organisation in Biological Systems

Abstract

Isolated systems tend to evolve towards thermal equilibrium, a special state that has been a research focus in physics for more than a century. By contrast, most processes studied in living and life-like systems are driven and far from thermal equilibrium. A fundamental overarching hallmark of all these processes is the emergence of structure, order, and information, and we are facing the major challenge of identifying the underlying physical principles. Two exciting problems are the self-organised formation of spatio-temporal patterns and the robust self-assembly of complex structures. In both fields, there have been recent advances in understanding the underlying physics that will be reviewed in this talk.

Short Bio

Prof. Dr. Erwin Frey is the chair of theoretical physics at Ludwig-Maximilians-Universität München, Germany, working at the interface of physics, nanoscience, and biology.

- His research focuses on theoretical approaches to understanding emergent phenomena in complex biomolecular systems.
- This includes the biophysics of biopolymers and the cytoskeleton, intercellular transport processes, self-assembly processes, and pattern formation.
- A central theme of his research is the identification and characterization of universal principles and mechanisms underlying living or life-like systems.

He is the recipient of multiple awards, including the Max-Planck Medal in 2024.

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