



UNIVERSITÀ
DEGLI STUDI
DI PADOVA

COLLOQUIA DFA A.A. 2025/26



Dipartimento
di Fisica
e Astronomia
Galileo Galilei



COLLOQUIUM DFA

OCTOBER 23RD 2025 - 3 PM

AULA ROSTAGNI
YOUTUBE STREAMING

ERWIN FREY

LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN

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.



Erwin Frey is currently Chair of Theoretical Physics at LMU Munich (since 2005; previously Professor at FU Berlin and Postdoc at Harvard). He develops quantitative theories for emergent phenomena in biomolecular and cellular systems, linking nonequilibrium statistical physics with biology. His group builds continuum and stochastic field theories for active polymers and cytoskeletal networks; formulates a general theory for reaction-diffusion models of intracellular pattern formation; and formulates kinetic and thermodynamic principles for intracellular transport, crowding, and phase separation. They use asymptotic and multiscale methods to connect molecular interactions to mesoscale dynamics, and propose minimal models that reveal universal mechanisms across living and life-like systems, from chemotaxis to evolutionary adaptation. He received the Max Planck Medal—the DPG's highest honor in theoretical physics—awarded in 2024 for fundamental contributions to theoretical biophysics (intercellular transport, biomolecular processes, pattern formation).

WEBSITE
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