Abstract

Oberwolfach Workshop:

Statistical Physics Out of Equilibrium:
Quantitative Results and Universality

Dates:

25 May - 30 May 2025   (Code: 2522)

Organizers:

Hugo Duminil-Copin, Genève/Bures-sur-Yvette
Patricia Gonçalves, Lisboa
Grégory Miermont, Lyon

This workshop aims at questioning the span and limitations of universal phenomena in probability theory, focusing as a core topic on in interacting particle systems, and exploring its connections to related areas including statistical physics and random geometry

Over the last 30 years, there has been spectacular progress in deriving the well-known hydrodynamic limits from stochastic interacting particle systems, as well as characterizing the fluctuations of locally conserved quantities around this limit. Many interesting results on the aforementioned topic have been derived from stochastic integrability, an approach relying on very specific combinatorial and algebraic properties of the underlying dynamics which allow deriving several scaling limits.

However, a microscopic change on the dynamics, can dramatically impact the macroscopic level, in the sense that scaling limits are no longer tractable by this methodology. Moreover, microscopic perturbations can lead to evolution equations with a variety of behaviours and at the critical parameter of the underlying dynamics, several universal anomalous laws can emerge, both in hydrodynamics and in fluctuations.

More generally, understanding critical points where physical systems undergo phase transitions, and establishing that the phenomenology is described by universal mathematical objects that do not depend on the specific properties of the underlying microscopic dynamics, is a cornerstone of modern probability and mathematical physics, both from a pure and an applied point of view. We aim at pursuing this ambitious goal by drawing a state-of-the-art.