Graduate School Event

Thesis Defense: Optimal Transport Methods for Kinetic Equations, Boundary Value Problems, and Discretization of Measures

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The theory of optimal transport provides an elegant and powerful description of many evolution equations as gradient flows. The primary objective of this thesis is to adapt and extend the theory to deal with important equations that are not covered by the classical framework, specifically boundary value problems and kinetic equations. Additionally, we establish new results in periodic homogenization for discrete dynamical optimal transport and in quantization of measures. Section 1.1 serves as an invitation to the classical theory of optimal transport, including the main definitions and a selection of well-established theorems. Sections 1.1-1.5 introduce the main results of this thesis, outline the motivations, and review the current state of the art. In Chapter 2, we consider the Fokker--Planck equation on a bounded set with positive Dirichlet boundary conditions. We construct a time-discrete scheme involving a modification of the Wasserstein distance and, under weak assumptions, prove its convergence to a solution of this boundary value problem. In dimension 1, we show that this solution is a gradient flow in a suitable space of measures. Chapter 3 presents joint work with Giovanni Brigati and Jan Maas. We introduce a new theory of optimal transport to describe and study particle systems at the mesoscopic scale. We prove adapted versions of some fundamental theorems, including the Benamou--Brenier formula and the identification of absolutely continuous curves of measures. Chapter 4 presents joint work with Lorenzo Portinale. We prove convergence of dynamical transportation functionals on periodic graphs in the large-scale limit, when the cost functional is asymptotically linear. Additionally, we show that discrete 1-Wasserstein distances converge to 1-Wasserstein distances constructed from crystalline norms on R^d. Chapter 5 concerns optimal empirical quantization: the problem of approximating a measure by the sum of n equally weighted Dirac deltas, so as to minimize the error in the p-Wasserstein distance. Our main result is an analog of Zador's theorem, providing asymptotic bounds for the minimal error as n tends to infinity.

Monday, October 6, 2025 09:30am - 10:30am
Central Bldg / O1 / Mondi 2a (I01.O1.008) and Zoom

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