



UNIVERSITÀ
DI TRENTO

Dipartimento di
Matematica

DOTTORATO



CYCLE 37th
ORAL DEFENCE OF THE PHD THESIS

Wednesday 30th April 2025 – 10.00 am

Department of Mathematics
Room A210 – Polo Ferrari 1

The event will take place in presence and online through the ZOOM platform.
To get the access codes, please contact the secretary office.

Viktorya Vardanyan

PhD Student in Mathematics

Stochastic Mean Field Games within Complex Systems and Interacting Particle Frameworks

Abstract:

This dissertation aims to analyze several advanced topics in stochastic analysis. We begin by examining diffusion approximations for transport equations with dissipative drifts, addressing both time-dependent and time-independent cases. We establish results on the existence and uniqueness of solutions for perturbed stochastic differential equations (SDEs) and demonstrate the convergence of these solutions to those of the unperturbed equations. These findings are then applied to the Cauchy problem and transport equations. Next, we explore mean field games (MFGs) with state dynamics described by stochastic differential equations affected by both idiosyncratic and common noise, and subject to the constraint that the terminal state variable belongs to a nonempty convex closed set. We derive the stochastic maximum principle (SMP) and introduce a suitable forward-backward stochastic differential equation (FBSDE) of conditional McKean-Vlasov type. Additionally, we apply our findings to MFGs of optimal investment. Finally, we investigate classical continuous systems characterized by singular velocity distributions, where the corresponding Radon measures are defined over the entire space with infinite mass. Given the inherent complexity of analyzing infinite-dimensional spaces, we tackle the problem by reformulating it onto a finite-dimensional configuration space. This is achieved by decomposing the infinite space into smaller, more manageable components. A central tool in this reformulation is the K-transform, which is pivotal in enabling harmonic analysis on the space. Furthermore, we extend previous results in the study of correlation functions by developing correlation measures tailored for these vector-valued Radon measures. Moreover, we define Gibbs measures on the cone of vector-valued measures and prove existence of such measures.

We define Gibbs measures as solutions to the Dobrushin-Lanford-Ruelle equation, focusing on the subset of tempered Gibbs measures. To prove the existence of the Gibbs measure, we show that the subset of tempered Gibbs measures is non-empty and relatively compact.

Supervisor: Luca Di Persio

CONTATTI

Staff di Dipartimento - Matematica
tel. 0461 281508-1625-1701-3786

phd.maths@unitn.it
www.maths.unitn.it