

Samy Mekkaoui

samy.mekkaoui@polytechnique.edu · +33 7 82 99 37 70

samymekk.github.io · samy-mekkaoui.linkedin.com

Research profile

I am currently a PhD student at *Ecole Polytechnique* since December 2024, supervised by Huy  n Pham and Idris Kharroubi on the topics of **mean field control theory** and **generative modeling**.

I am developing new approaches to generate time series based on an optimal control point of view and working on a new type of mean-field control problem where one seeks to control the interactions between the agents. I am also interested more generally on optimization problems over the space of measures, for instance using Wasserstein gradient flows.

I am currently seeking a **research internship of at least three months** for the summer of 2027, during the third year of my PhD. Longer internships are also of interest.

Education

University of California, Berkeley

Visiting Researcher

Subject : Mean-field control theory.

Supervisor: Xin Guo.

Oct 2026 – Jan 2027

Berkeley, CA

  cole Polytechnique, CMAP

PhD Student, Applied Mathematics

Thesis : Applications of McKean-Vlasov processes:

From non exchangeable mean field systems to generative modeling.

Funding: **Qube Research & Technologies**.

Supervisors: Huy  n Pham and Idris Kharroubi.

2025 – 2028

Palaiseau, France

Master M2MO, Universit   Paris Cit  

MSc in Quantitative Finance

Obtained with Highest honors

2023 – 2024

Paris, France

ENSAE Paris, Institut Polytechnique de Paris

Engineering Degree in Applied Mathematics

Obtained with Highest honors

Member of the **French Actuariat Institute** since November 2024.

2020 – 2024

Palaiseau, France

Marcelin Berthelot

*CPGE MPSI-MP**

2018 – 2020

Paris, France

Professional experience

Mazars

Quantitative Researcher

- Deep learning methods for the computation of X-Valuation Adjustments (XVA). Dissertation available [here](#).

May – November 2024

Paris, France

Caisse des Depots

Quantitative ALM Analysis

- Interest rate modelling for the computation of the Fonds d'  pargne capital requirements.

January – July 2023

Paris, France

Publications

- **Stochastic maximum principle for optimal control problem of non exchangeable mean field systems.** CMAP-Ecole Polytechnique, June 2025. Co-authored with Idris Kharroubi and Huy  n Pham. Published to Mathematical Control and Related Fields.
- **Optimal control of heterogeneous mean-field stochastic differential equations with common noise.** CMAP-Ecole Polytechnique, November 2025. Co-authored with Filippo de Feo. Submitted to SIAM Journal on Control and Optimization.
- **Non-exchangeable mean field Markov decision processes: from Bellman equation to quantitative propagation of chaos.** CMAP-Ecole Polytechnique, February 2026. Co-authored with Huy  n Pham. Submitted to Applied Mathematics and Optimization.
- **Learning operators on labelled conditional distributions with applications to mean field control of non exchangeable systems.** CMAP-Ecole Polytechnique, March 2026. Co-authored with Huy  n Pham and Xavier Warin. Submitted to Mathematics of Computation.
- **Learning Generative Dynamics with Soft Law Constraints: A McKean-Vlasov FBSDE Approach.** CMAP-Ecole Polytechnique, May 2026. Co-authored with Samer El Boustany, Yadh Hafsi, Alexandre Alouadi and Huy  n Pham.
- **Policy Gradient Learning for Distributionally Robust Markov Decision Processes under Wasserstein Ambiguity.** CMAP-Ecole Polytechnique, June 2026. Co-authored with Yadh Hafsi, Huy  n Pham and Kaixin Yan.

Working papers

- **Stochastic Maximum Principle for Path-Dependent McKean-Vlasov Control with Applications to Financial Time Series Modeling.** CMAP-Ecole Polytechnique, planned for August 2026. Co-authored with Yadh Hafsi and Huy  n Pham. Planned to be submitted to SIAM Journal on Control and Optimization.
- **Path dependent mean-field control in discrete time with applications to linear quadratic control problems and generative AI.** CMAP-Ecole Polytechnique, planned for August 2026. Co-authored with Amine Zitouni and Huy  n Pham. Planned to be submitted to Automatica.
- **Policy gradient algorithms for mean field control problems for general state space: A randomization approach.** CMAP-Ecole Polytechnique, planned for September 2026. Co-authored with Adonis Jamal and Huy  n Pham.
- **Heterogeneous Wasserstein Gradient Flows: From Non-Exchangeable Mean-Field Systems to Time-Series Modeling.** CMAP-Ecole Polytechnique, planned for January 2027. Co-authored with Cl  ment Bonet and Anna Korba.
- **Non-exchangeable mean field Markov decision processes with controlled interactions.** CMAP-Ecole Polytechnique, planned for 2027. Co-authored with Huy  n Pham.

Invited talks

- **Mean Field Games and Applications**, Humboldt University of Berlin, Berlin, Germany. July 22, 2025. Presented my work on *Stochastic maximum principle for optimal control problem of non exchangeable mean field systems and application to linear quadratic systems*. Information about the event and slides are available [here](#).
- **Conference Advances in Financial Mathematics 2026**, Sorbonne Universit  , Paris, France. January 27, 2026. Presented my work on *Stochastic maximum principle for optimal control problem of non exchangeable mean field systems and application to linear quadratic systems* and on *Operator Learning on labelled conditional distribution*. Information about the event is available [here](#).
- **Stochastic Control and Games for Risk and Regulation**, Royal Tulip Taj Sultan, Hammamet, Tunisia. April 27, 2026. Presented my work on *Learning operators on labelled conditional distributions with applications to mean field control of non exchangeable systems*. Information about the event is available [here](#).

- **Bachelier Conference**, Bologna, Italy. June 29, 2026. I will present my work on *Learning operators on labelled conditional distributions with applications to mean field control of non exchangeable systems*. Information about the event is available [here](#).
- **Generative diffusion models through stochastic control and optimal transport**, Oxford, England. September 2026. I will present my work based on McKean-Vlasov diffusion processes and FBSDE approaches for generative modelling.
- **Mathematical Finance seminar**, Stanford University, USA. November 2026. I am invited by Renyuan Xu to present my recent work on McKean-Vlasov processes for time series modeling. I will also present my recent research on Heterogeneous Wasserstein gradient flows and their link to path dependent McKean-Vlasov processes.

Teaching experience

Ecole Polytechnique - Master El Karoui

Stochastic control and Machine Learning

Organizer and instructor of the lab sessions for the course Stochastic Control and Machine Learning, taught by Huy  n Pham. Course materials and information are available on the course website available [here](#).

Jan 2026 – Now

Palaiseau, France

ENSAE Paris

Financial Mathematics

Teaching Assistant for the M1 Financial Mathematics course at ENSAE Paris

Jan 2025 – Now

Palaiseau, France

Ecole Polytechnique

Probability and Statistics

Teaching Assistant for third-year undergraduate (L3) students at   cole Polytechnique in Probability and Statistics.

Sep 2025 – Dec 2025

Palaiseau, France

ENSAE Paris

Probability Theory

Teaching Assistant for third-year undergraduate (L3) students at ENSAE Paris in Probability Theory.

Jan 2025 – Jun 2025

Palaiseau, France

Student supervision

- **Adonis Jamal**: April 2026 – November 2026. Adonis, a graduate of CentraleSupélec and the MVA Master’s program, is currently conducting a research internship at CMAP under the supervision of Huy  n Pham and myself. His work focuses on the development and analysis of **reinforcement learning algorithms** for mean-field control problems.
- **Amine Zitoun**: April 2026 – August 2026. Amine is currently a student at Ecole Polytechnique and is completing his third-year research internship at CMAP under the supervision of Huy  n Pham and myself. His work focuses on the development of **mean-field control methods for generative modeling of time series**. Starting next year, he will pursue the El Karoui Master’s program.