Matteo D'Achille

CURRICULUM VITÆ

Address and contacts

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Main research interests

Statistical and Mathematical Physics, Probability, Random Geometry

Current position

2022- Postdoctoral Fellow, Laboratoire de Mathématiques d'Orsay (LMO, UMR 8628), université Paris-Saclay, with Nicolas Curien and Nathanaël Enriquez

Past affiliations

2020-2022 Research and Teaching Assistant, Laboratoire d'Analyse et de Mathématiques Appliquées (LAMA), UMR 8050 CNRS, Université Paris-Est Créteil (UPEC), with Arnaud Le Ny

2019-2020 Associated Member, Laboratoire d'Informatique de Paris Nord (LIPN), UMR 7030 CNRS, Université Sorbonne Paris Nord (Paris XIII), with Andrea Sportiello

Education

2020 **Ph.D.** Paris-Saclay University
Thesis title: *Statistical Properties of the Euclidean Random Assignment Problem*
Supervisors: William Jalby, Olivier Rivoire and Andrea Sportiello
Thesis Defended on October 16, 2020 before the Committee composed by: Michel Ledoux (president), Charles Bordenave (referee), Massimiliano Gubinelli (referee), Guilhem Semerjian (examiner), Lenka Zdeborová (examiner), Sergio Caracciolo (invited member)

2016 **M.Sc.** University of Milan, 110/110 summa cum laude
Thesis title: *On two linear assignment problems: random assignment and Euclidean bipartite matching*
Supervisor: Sergio Caracciolo
Assistant Supervisor: Gabriele Sicuro

2012 **B.Sc.** University of Milan, 110/110
Thesis title: *La teoria di Schwarz-Christoffel e il Biliardo Quantistico Poligonale*
Supervisor: Luca Guido Molinari

Long Scientific Stays

2021 One week visit (22/11-29/11), Pisa Mathematics Department, Italy. Host: Dario Trevisan.

Two weeks visit (09/09-24/09), CASA, TU/E, Eindhoven, Netherlands. Host: Oliver Tse.

2018 Two weeks visit (18/02-04/03), Banach Center; Polish Academy of Sciences, Warsaw, Poland. Host: Jacek Miękisz.

Publications

Preprints

2023 1. "Ideal Poisson-Voronoi tessellations on hyperbolic spaces, I", with N. Curien, N. Enriquez, R. Lyons and M. Ünel. arXiv: 2303.16831 [math.PR]

Published in peer-reviewed journals

2022 8. "Decimations for Two Dimensional Ising and Rotator Models II: Continuous versus Discrete Symmetries", with A. van Enter and A. Le Ny, *Journal of Mathematical Physics* **63** 63, 123506,. doi: 10.1063/5.0103163

7. "Decimations for Two-dimensional Ising and Rotator Models", with A. van Enter and A. Le Ny, *Journal of Mathematical Physics* **63** 63, 033506. doi: 10.1063/5.0057174

6. "Almost Gibbsian Measures on a Cayley Tree", with A. Le Ny, *Markov Processes and Related Fields* **28**, pp. 245–273. arXiv: 2105.05767 [math-ph]

2021 5. "Random Assignment Problems on $2d$ Manifolds", with D. Benedetto, E. Caglioti, S. Caracciolo, G. Sicuro and A. Sportiello, *Journal of Statistical Physics* **183**, art. 34, doi: 10.1007/s10955-021-02768-4

2020 4. "The Dyck bound in the concave 1-dimensional random assignment model", with S. Caracciolo, V. Erba and A. Sportiello, *Journal of Physics A: Mathematical and Theoretical* **53** (6), 064001 doi: 10.1088/1751-8121/ab4a34

2018 3. "Anomalous scaling of the optimal cost in the one-dimensional random assignment problem", with S. Caracciolo and G. Sicuro, *Journal of Statistical Physics* **174** (4), 846–864, doi: 10.1007/s10955-018-2212-9

2017 2. "Random Euclidean matching problems in one dimension", with S. Caracciolo and G. Sicuro, *Physical Review E* **96** (4), 42102, doi: 10.1103/PhysRevE.96.042102

1. "Finite-size corrections in the random assignment problem", with S. Caracciolo, E.M. Malatesta and G. Sicuro, *Physical Review E* **95** (5), 52129, doi: 10.1103/PhysRevE.95.052129

Talks in presence (P) or in visioconference (V)

2023

17/01 - Random Geometry - Géométrie Aléatoire, CIRM Marseilles Luminy (website) P
ERAPs: state of art in 1d and future perspectives, 60 min

2022

06/12 - Probability and Statistics Seminar, LAGA, Sorbonne Paris Nord (site web) P
Decimation and the spin-flop transition in the XY model on Z^2, 50 min

22/09 - Back-to-school day of probastat team of LMO, université Paris-Saclay (website) P
La fonction ϑ_4 de Jacobi dans l'ERAP sur le cercle unitaire, 30 min

06/09 - Optimal Transport & Uncertainty - 2nd Edition, University of Naples, IT (site web) P
Lattice Helmholtz decomposition in a two-dimensional ERAP, 45 min

20/06 - DYOGENE Seminar, INRIA and École Normale Supérieure (website) P
Back and forth between the beta distribution and edge stochastic domination in ERAPs, 60 min

08/03 - Séminaire de probabilité de Créteil, université Paris-Est Créteil, FR (website) P
Décimation dans les modèles d'Ising et XY à $d \leq 2$, 60 min

18/02 - Les probas du vendredi, Sorbonne Université, Paris, FR (website) P
ERAP : du pont brownien à la fonction ϑ_4 de Jacobi, 60 min

2021

26/11 - Optimal Transport & Uncertainty, Pisa University, IT (website) P
Euclidean Random Assignment Problems, old and new, 45 min

14/09 - SPOR Seminar, EURANDOM, TU/E, Eindhoven, NL (website) P
One dimensional ERAPs: anomalous scaling and critical hyperbolae, 45 min

07/07 - Franco-Dutch meeting, CNRS IRP, Institut Henri Poincaré, Paris, FR (website) P
On the phase diagram of Euclidean Random Assignment Problems at low dimensions, 40 min

23/06 - 1st Italian Society of Statistical Physics (SIFS) conference, Parma, IT (recording) V
Consequences of Weyl's law in low-dimensional Euclidean Random Assignment Problems, 12 min

21/06 - Journées de Probabilités 2021, Guidel Plages, FR (website) P
Euclidean Random Assignment Problems: origin, state of the art and some open problems in one dimension, 40 min

18/03 - ALÉA Days 2021, CIRM Marseilles Luminy, FR (website) V
Multiple zeta-star values in the one dimensional ERAP with stretched-exponentially distributed points, 20 min

21/02 - Laboratoire Painlevé, Université de Lille, Lille, FR (website) V
Différences d'énergie asymptotique dans l'ERAP sur des variétés bidimensionnelles, 45 min

2020 10/11 - Probability and Statistics Seminar, Université Paris-Est Créteil, Créteil, FR (website) P
Le problème d'assignation aléatoire euclidienne: état de l'art et quelques problèmes ouverts en dimension $d \leq 2$, 45 min

16/10 - PhD Thesis Defense, Université Paris-Saclay, FR V
Statistical properties of the Euclidean random assignment problem, 45 min

14/01 - Combinatorics Seminar, Université Sorbonne Paris Nord, Villataneuse, FR (website) P
Le problème d'assignation aléatoire euclidienne: état de l'art et quelques résultats récents en dimension $d = 1$, 45 min

Students supervision

2022 April 11st - July 11st : Yuqi LIU
M2 research Stage, M2 Mathématiques et Applications, université Paris-Est Créteil
Project title : *Two-dimensional Euclidean Random Assignment Problems with two kinds of points having different distributions*
Yuqi's stage is supported by a stipend from université Paris-Est Créteil.

2022 February-May: Yilun LI, Mouad HAÏ
"Travaux d'Etude et Recherche" (TER), M1 Mathématiques et Applications, université Paris-Est Créteil
Report title : *Équations de Mathieu et ERAPs sur des domaines elliptiques à* $p = 2$

2021 February-May : Moustapha Mouhamadou BA, Yuqi LIU, Issa Konate SY
"Travaux d'Etude et Recherche" (TER), M1 Mathématiques et Applications, université Paris-Est Créteil
Report title : *Universalité dans le problème d'assignation aléatoire euclidienne en dimension* $d = 1$

Referee activity in peer-reviewed journals

2017- Chaos (AIP), Electronic Journal of Probability (IMS), Physical Review X (APS), IEEE Transactions on Information Theory

(Co-)Organization of scientific activities

2022- Co-organizer of the recurring conference "**Les Probabilités de Demain**", at Institut Henri-Poincaré in Paris. With Q. Berger, H. Halconruy, Ł. Mądry, A. Ocello and Y. Wan
Website : https://www.lesprobabilitesdedemain.fr/

2022 Co-organizer of the conference "**The many facets of Statistical Field Theory**" in honor of Sergio Caracciolo 70th birthday, SISSA - International School for Advanced Studies, Trieste, Italie. With P. Calabrese, A. Gambassi, M. Gherardi, E. Malatesta, L. Molinari, P. Rotondo, G. Sicuro and C. Vanoni.
Website : https://sites.google.com/view/the-many-facets-of-sft - YouTube channel

2021- Co-organizer of the webinar "**Seed Seminar of Mathematics and Physics**". With A. El Fardi and E. Kilinçarslan
Website : https://seedseminar.apps.math.cnrs.fr/ - YouTube channel

Membership of Scientific Societies

2019- Italian Society of Statistical Physics (SIFS), voting member
2017- European Physical Society (EPS), individual member
2013- Italian Physical Society (SIF), voting member

Other memberships

2019- Member of the WIMS EDU association (website)

Participation in Evaluation Committees

2021 TER M1 committee, Université Paris-Est Créteil.
Composition: MD'A, Raphaël Danchin, Stéphane Sabourau, Etienne Sandier, Stéphane Seuret, Julien Sohier.

Teaching activities

2020-current Teaching Assistant (Mathematics), Université Paris-Est Créteil (∼192 hours for 2nd-3rd year Bachelor students in Economics, *ongoing*)

Spring Term 2022: Tutorials/Course, "**Statistical Inference**" by S. Laruelle.
Program: point estimators, confidence interval estimators, statistical tests, least squares.

Fall Term 2021: Tutorials,"**Mathematics for Dynamical Systems**" by A. Deshayes.
Program: sequences, 1st and 2nd order recurrent equations, 1st and 2nd order ODEs, higher order ODEs, recurrent systems.
Tutorials/Course,"**Probability**" by S. Laruelle.
Program: Introduction to Probability, discrete and continuous random variables, convergence of random variables, limit theorems.

Spring Term 2021: Tutorials/Course, "**Statistical Inference**" by S. Laruelle.
Program: point estimators, confidence interval estimators, statistical tests, least squares.

Fall Term 2020: Tutorials, "**Mathematics for Dynamical Systems**" by A. Le Ny.
Program: dynamical systems in discrete time dynamical systems in continuous time, applications to models in Economics.

2019-2020 *Lecturer (Mathematics)*, Paris-Saclay University (Orsay) (15 hours for 1st year Bachelor students in Mathematics, Physics and Informatics)

Spring Term 2020: WIMS, "**Remédiation en Mathématiques (OuiSi)**" by G. Moreau.
Program: basic operations, Euclidean geometry, trigonometry, functions, complex numbers, mean value theorem, integral calculus.

2018-2019 *Tutor (Mathematics)*, Paris-Saclay University (Orsay) (65 hours for 1st year Bachelor students in Mathematics, Physics and Informatics, and dual Bachelor "Physico-Chimie")

Spring Term 2019: Tutorials+WIMS," **Remédiation en Mathématiques (OuiSi)**" by G. Moreau.
Program: basic operations, Euclidean geometry, trigonometry, functions, complex numbers, mean value theorem, integral calculus.

Fall Term 2018: Tutorials, "**Calculus Math 151**" by G. David.
Program: functions, limits and continuity, Taylor expansion, derivative, parametric curves, behaviors of functions over a closed and bounded interval, Taylor expansion of order ≥ 2, ODEs, primitives and integrals, functions of several variables.

Participation as auditor to research schools, conferences, seminars, workshops

2023 Inhomogeneous Random Systems, IHP and Institut Curie, Paris (website)

2022 Journée cartes, ENS Lyon, FR (website)

Journées Postdoc de la Fondation Mathématique Jacques Hadamard, IHES, FR (website)

Lille Days in Point Processes and Stochastic Geometry, IMT Nord Europe, Lille, FR (website)

Journée Aleatoire 2022, Institut Henri Poincaré, Paris (website)

Journées MAS 2022, Rouen, FR (website)

Random Point Processes in Statistical Physics, Harnack-Haus, Berlin, DE (site web)

10th Anniversary of the Bézout Labex, université Gustave Eiffel, Champs-sur-Marne, FR (website)

100 (102!) Years of the Ising Model, IHES, Bures-sur-Yvette, FR (website)

2022 Random matrices meet random permutations, Lille, FR (website)

Journées ALEA 2022, CIRM Luminy, FR (website)

Quantization, Location, Sampling and Matching, Centre Lagrange, Paris (website)

Inhomogeneous Random Systems, IHP and Institut Curie, Paris (website)

2021 Optimal Transport and Uncertainty, Pisa, IT (website)

Stochastic Geometry Days Dunkerque, FR (website)

Franco-Dutch meeting Bézout-Eurandom IHP, Paris (website)

Journées Processus de Hawkes, IHP, Paris (website)

Journées de probabilités 2021, Guidel, FR (website)

Theory of Probability and Its Applications: P.L. Chebyshev - 200, Moscow, RU (website)

Journées Aléa 2021, Research School, CIRM Marseilles Luminy, FR, (website)

Inhomogeneous Random Systems, IHP and Institut Curie, Paris (website)

2020 Integrable Probability Online Summer School, Clay Mathematics Institute & Heilbronn Institute for Mathematical Research, Zoom virtual sessions (website)

Journées de combinatoire de Bordeaux 2020, LaBRI, Université de Bordeaux, FR (website)

2019 Combinatorics and Arithmetic for Physics: special days meeting, Marilyn and James Simons Conference Center, IHES, Le Bois-Marie, Bures-sur-Yvette, FR (website)

Journées MathSTIC 2019 – Probabilités et Combinatoire workshop, Bâtiment Galilée, Université Paris 13, Villetaneuse, FR (website)

2018 Paths in Statistical Physics, Physics Department, Université Paris Diderot, FR (website)

Information transmission in biological systems conférence, Simons Semester on Mathematical Biology, Mathematical Research and Conference Center, Będlewo, Poland (website)

2016 Optimal Transport and Applications, Scuola Normale Superiore, Pisa, IT (website)

2014 Mathematical Physics, Analysis and Stochastics, Universität Heidelberg, DE (website)

Languages

Italian (native), French (advanced), English (advanced), Spanish (beginner)

Programming languages and computer skills of everyday use

C++, Python, Wolfram Language™
LaTeX, HTML, CSS

Last updated: March 30, 2023