Antoine Maillard Postdoctoral researcher

HG G 21.1, ETH Zurich,
Ramistrasse 101
8092 Zurich, Switzerland

Personal webpage: anmaillard.github.io
email: antoine.maillard@math.ethz.ch

About me

I am a Hermann-Weyl-Instructor (postdoc) at the Department of Mathematics at ETH Zurich, working in the group of Prof. Afonso Bandeira. I defended my PhD on August 30$^{\text{th}}$ 2021, which was prepared at École Normale Supérieure (ENS) de Paris, under the supervision of Profs. Florent Krzakala and Lenka Zdeborová.
My research is at the intersection of high-dimensional statistics, statistical physics, information theory and random matrix theory.

Occupation

Hermann-Weyl instructor (postdoc) at ETH Zurich *Oct 2021 - Now*
Postdoctoral position at the Department of Mathematics at ETH Zurich.
Mentored by Afonso Bandeira.

Education

PhD in theoretical physics *2018-2021*
"Fundamental limits of high-dimensional estimation",
Advised by Prof. Florent Krzakala & Prof. Lenka Zdeborová.
École Normale Supérieure, Paris, France

École Normale Supérieure graduate degree *2013-2018*
Additional research-oriented Master's degree validating my studies at École Normale Supérieure.

Studies at École Normale Supérieure (Paris) *2013-2018*
- M.Sc. in Theoretical Physics (ranked 1$^{\text{st}}$/140, grade: 18.82/20)
- Master 1 in Mathematics (overall grade: 17.86/20)
- B.Sc. in Physics (ranked 2$^{\text{nd}}$/35, grade: 18.8/20)

Classes Préparatoires, *Lycée Sainte Geneviève, Versailles, France* *2011-2013*
Admitted at ENS by competitive exams ("concours").

Teaching

Student seminar on Matrix Discrepancy *Spring 2022*
Organization of a student seminar at ETH Zurich.

Theses supervision at ETH Zurich *2021-Now*
Bachelor students: Fabio Hehli, Yan L'Homme.

Teaching Assistant *2019-2020*
"Mathematics for Physicists", taught by Prof. Van Wijland at ENS.

Competitive exams preparation at ENS *2019-2020*
Participation in the design of competitive exams ("concours") subjects.

Private lessons *2013-2020*
From highschool to bachelor degree, in physics and mathematics.

Awards & Fellowships

Prix de thèse Daniel Guinier *2022*
PhD prize of the Société Française de Physique.

Ph.D scholarship "Jean-Pierre Aguilar" *2018-2021*
Competitive Ph.D scholarship from Fondation CFM pour la recherche.

Visits & internships

Visit to Prof. Afonso Bandeira (ETHZ, Zurich) *Feb-Apr 2020*

Research internship, NYU (Shanghai & NYC) *Feb-Jul 2018*
Energy landscape of inference models, advised by G.Ben Arous.

Research internship, École Normale Supérieure (Paris) *Sep 2017-*

Statistical learning and inference, advised by F.Krzakala. *Feb 2018*

Research internship, Capital Fund Management (Paris) *Sep 2016-*

Message-passing algorithms for optimization of discrete trade systems, advised by J-P. Bouchaud and F.Altarelli. *Feb 2017*

Research internship, CERN (Geneva, Switzerland) *Jun-Jul 2016*

Quadrupole structures for transverse Landau damping in circular accelerators, in the team of E.Métral.

Research internship, CEA & Collège de France (Paris) *Jan-May 2016*

Out-of-equilibrium real-time computations in quantum impurity models by Monte-Carlo methods, advised by O.Parcollet & A.Georges.

Research internship, Perimeter Institute (Waterloo, Canada) *Feb-Jul 2015*

Islands of stability and recurrence times in Anti-de-Sitter spacetimes, advised by S.Green & L.Lehner.

Intensive arabic internship (Cairo, Egypt) *Aug-Sep 2014*

At the "Institut Francais d'Égypte", in El Mounira.

Some invited talks & workshops

Injectivity of ReLU networks *Sep. 2022*
Les Diablerets "Workshop on Spin Glasses".

Some advances on extensive-rank matrix factorization *Nov. 2021*
Invited seminar at EPFL, Lausanne.

Probability seminar, university of Basel *Oct. 2021*
Invited by David Belius & Jiří Černý .

Rigorous Evidence for Information-Computation Trade-offs *Sep. 2021*
Simons Institute for the Theory of Computing, Berkeley.

Random Matrix Theory and Networks *Jun. 2021*
Max Planck Institute for the Physics of Complex Systems, Dresden.

Statistical Physics and Machine Learning *Aug. 2020*
Les Houches summer school, France.

Youth in high-dimensions *Spring 2020*
International Center for Theoretical Physics, Trieste.

Science of data science *Fall 2019*
International Center for Theoretical Physics, Trieste.

The rough high-dimensional landscape problem *Winter 2019*
Kavli Institute for Theoretical Physics, Santa Barbara.

Cargese summer school *Summer 2018*
Statistical physics and machine learning back together.

Beg Rohu summer school *Summer 2018*
Deep learning and statistical physics.

Other resp--onsabilities

Organization of the DACO seminar from Fall 2021 until now.
Outstanding Reviewer award at ICLR 2021
Reviewer for conferences : CAMSAP, NeurIPS, ICLR, ICML
Reviewer for journals : Foundations of Computational Mathematics, JSAIT, J. Stat. Mech., J. Phys. A

Languages

French (Native), **English** (Fluent), **Arabic** (Conversational), **German** (Basic).

Publications & Preprints

A.S.Bandeira, A.M., R.Nickl and S.Wang, *On free energy barriers in Gaussian priors and failure of MCMC for high-dimensional unimodal distributions*, arXiv preprint arXiv:2209.02001.

A.S.Bandeira, A.M. and N.Zhivotovskiy, *A remark on Kashin's discrepancy argument and partial coloring in the Komlós conjecture*, arXiv preprint arXiv:2206.08734.

J.Dong, L,Valzania, A.M., T.A.Pham, S.Gigan and M.Unser, *Phase Retrieval: From Computational Imaging to Machine Learning*, arXiv preprint arXiv:2204.03554.

E.Troiani, V.Erba, F.Krzakala, A.M. and L.Zdeborová, *Optimal denoising of rotationally invariant rectangular matrices*, arXiv preprint arXiv:2203.07752.

A.M., F.Krzakala, M.Mézard and L.Zdeborová, *Perturbative construction of mean-field equations in extensive-rank matrix factorization and denoising*, Journal of Statistical Mechanics: Theory and Experiment 2022 (8), 083301.

A.M., F.Krzakala, Y.M.Lu and L.Zdeborová, *Construction of optimal spectral methods in phase retrieval*, MSML 2021.

A.M., *Large deviations of extreme eigenvalues of generalized sample covariance matrices*, EPL (Europhysics Letters), 2021, vol. 133, no 2, p. 20005..

A.M., B.Loureiro, F.Krzakala and L.Zdeborová, *Phase retrieval in high dimensions: statistical and computational phase transitions*, NeurIPS 2020.

A.M., G.Ben Arous, G.Biroli, *Landscape complexity for the empirical risk of generalized linear models*, Mathematical and Scientific Machine Learning, 2020.

B.Aubin, B.Loureiro, A.M., F.Krzakala and L.Zdeborová, *The spiked matrix model with generative priors*, in IEEE Transactions on Information Theory, 2020 & NeurIPS 2019.

A.M., L.Foini, A.Lage Castellanos, F.Krzakala, M.Mézard and L.Zdeborová, *High temperature expansions and message passing algorithms*, Journal of Statistical Mechanics: Theory and Experiment 2019.11 (2019): 113301.

C.Bertrand, O.Parcollet, A.M. and X.Waintal, *A Quantum Monte Carlo algorithm for out-of-equilibrium Green's functions at long times*, Phys.Rev.B 100, 125129.

M.Schenk, X.Buffat, K.Li and A.M., *Vlasov description of the effects of nonlinear chromaticity on transverse coherent beam instabilities*, Phys.Rev.Accel.Beams 21, 084402.

B.Aubin, A.M., J.Barbier, N.Macris, F.Krzakala and L.Zdeborová, *The committee machine: Computational to statistical gaps in learning a two-layers neural network*, J.Stat.Mech. (2019) 124023 & NeurIPS 2018.

J.Barbier, A.M., N.Macris and F.Krzakala, *The Mutual Information in Random Linear Estimation Beyond iid Matrices*, ISIT 2018: 1390-1394.

S.Green, A.M. and L.Lehner, *Islands of stability and recurrence times in Anti de Sitter space-time*, Phys.Rev.D 92, 084001.