Dr. Dominik Schröder

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Education

Maria-Theresia-Gymnasium — *München*

Abitur — *2001 – 2010*

ETH Zürich — *Zürich*

Mathematics & Physics — *2010 – 2011*

LMU München — *München*

Mathematics & Physics — *2011 – 2014*

- **BSc in Mathematics.** Final grade *1.08*
  Bachelor thesis "The Integrated Density of States of Random Schrödinger Operators" supervised by Prof. Dr. Peter Müller.
- **MSc in Theoretical and Mathematical Physics** with distinction (final grade *1.0*)
  Master thesis "Phase Transition in the Density of States of Quantum Spin Glasses" supervised by Prof. Dr. László Erdős.

University of Cambridge — *Cambridge*

Mathematics — *2014 – 2015*

- **MASt in Mathematics.** with *distinction*
  Essay "Interlacing Families and the Kadison-Singer Problem" supervised by Prof. Timothy Gowers.

IST Austria — *Wien*

Mathematics — *Sep 2015 – Mär 2019*

- **PhD in Mathematics.**
  Doctoral thesis "From Dyson to Pearcey: Universal Statistics in Random Matrix Theory" supervised by Prof. Dr. László Erdős.

Positions

Bosch Center for Artificial Intelligence — *Renningen*

Industry Sabbatical (during the PhD) — *Apr 2018 – Aug 2018*

- Work on clustering of image and audio data
- Focus: Analyis of facets of the lifted multicut polytope on paths
- Goal: Combination of initial segmentation by neural networks with additional expert knowledge

IST Austria — *Wien*

Postdoc — *Mar 2019 – Sep 2019*

ETH Zürich — *Zürich*

Postdoc — *since Oct 2019*

- 2019–2022: *Junior Fellow* at the ETH Institute for Theoretical Studies,
- Since 2022: *SNF Ambizione Independence Grant*
- Mentors: Prof. Vincent Tassion, Prof. Wendelin Werner & Prof. Alain-Sol Sznitman

Prizes & Fellowships

2010 – 2015	**Studienstiftung des deutschen Volkes,** Scholarship	
2015	**Horne Prizes for Physical Sciences**	*Clare College, Cambridge*
2015 – 2017	**IST Austria Excellence Scholarship**	*IST Austria*
2019 – 2022	**ITS Junior Fellow** supported by Dr. Rössler and the Walter Haefner Foundation	*ETH Zürich*

Acquired funding

2022 – 2026 **SNF (Schweizerischer Nationalfonds) Ambizione.** Value CHF544,720
Project: *Random matrix universality in data science and theoretical physics*

Publications

ORCiD ID `orcid.org/0000-0002-2904-1856`
Google Scholar `scholar.google.com/citations?user=u3ilHrcAAAAJ` *h-index: 16*
Full Publication List `n.ethz.ch/~dschroeder/publications.pdf`

Machine learning theory

3 Publications:

- Analysis of one-hidden-layer Neural Networks via the Resolvent Method, ***NeurIPS 2021***
- Deterministic Equivalent and Error Universality of Deep Random Features Learning, ***ICML 2023***
- Asymptotics of Learning with Deep Structured (Random) Features, ***ICML 2024***

Random matrix theory

22 publications. Key publications:

- Random Matrices with Slow Correlation Decay, ***Forum of Mathematics, Sigma***
- Edge Universality for non-Hermitian Random Matrices, ***Probab. Theory Related Fields***
- Central Limit Theorem for Linear Eigenvalue Statistics of non-Hermitian Random Matrices, ***Comm. Pure Appl. Math.***
- Normal Fluctuation in Quantum Ergodicity for Wigner Matrices, *in revision at* ***Ann. Probab.***

Free probability

2 publication

- Thermalisation for Wigner matrices, ***J. Funct. Anal.***
- Matrix Concentration Inequalities and Free Probability II. Two-sided Bounds and Applications, ***preprint***

Numerical analysis

1 publication

- On the condition number of the shifted real Ginibre ensemble, ***SIAM J. Matrix Anal. Appl.***

Statistical physics

1 publication

- Phase transition in the density of states of quantum spin glasses, ***Math. Phys. Anal. Geom.***

Machine Learning / Programming

Cortical Silent Period (cSP) evaluation algorithm

`wirhabenzeit/csp`

Deep Learning

Regression on EEG data using resnet for a clinical study (ongoing work). Written in Python (PyTorch), inference and visualization in JavaScript (onnxruntime)

ActivityMap `wirhabenzeit/stravamap`

Web Application

Map and statistical analysis of personal outdoor activities. Written in Typescript (React.js, D3.js), integration with large language model (GPT-4) for unstructured data analysis

pybibget `wirhabenzeit/pybibget`

Command Line Utility

Download and manage bibtex entries from arXiv, Google Scholar, and other sources. Written in Python

Programming Skills

Python	Advanced, including deep learning frameworks (PyTorch, TensorFlow)
Typescript	Avanced, including React, Node.js, D3.js
SQL	Intermediate
C++	Basic

Teaching experience

Lecture *ETH Zürich*

Probability Theory *2022*

	Motivation	Clarity	Script	Structure
Evaluation	4.5/5.0	4.3/5.0	4.4/5.0	4.4/5.0

Lecture series *ETH Zürich*

Medley in Advanced Probability *2020*

Supervision of students

Master thesis *ETH Zürich*

Vanessa Piccolo: "Asymptotic spectral density of non-linear random matrix models" *2020 – 2021*

Won the "Premio Pro Ticino Zurigo" prize

Master thesis *ETH Zürich*

Yannick Egg: "Community detection in the stochastic block model" *2023-2024*

Bachelor thesis *ETH Zürich*

Nicolas Hotton: "The BBP phase transition in principal component analysis" *2023*

Bachelor thesis *ETH Zürich*

Sven Keller: "Existence of infinite families of Ramanujan graphs via the probabilistc method" *2024*

Semester papers *ETH Zürich*

Topics: Dyson Brownian Motion, Random Matrix Theory, Principal Component Analysis *2021–2023*

Miscellaneous

Jul – Aug 2010 **Volunteer teacher for mathematics & english,** Godavari State School *Nepal*