

Paul Peter Hager

Curriculum Vitae

Humboldt University Berlin
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Education

- April 2019 - September 2021 **Dr. rer. nat.**, Technische Universität Berlin / Berlin Mathematical School, graduated with “summa cum laude”, Thesis: “*Rough Analysis with Application in Markets and Related Fields*”, supervision by Prof. P. K. Friz and Dr. habil. C. Bayer.
- April 2016 - March 2019 **Master of Science**, Technische Universität Berlin Mathematics with emphasis on stochastic analysis and mathematical finance, Thesis: “*The Multiplicative Chaos of Fractional Brownian Motions with Vanishing Hurst Parameters*”, supervision by Prof. P. K. Friz.
- September 2012 - March 2016 **Bachelor of Science**, Technische Universität Berlin, Mathematics with emphasis on probability theory, Thesis: “*Bayesian Change Point Detection with an Asymmetric Miss Criterion*”, supervision by Prof. P. Bank.
- September 2009 - August 2012 **Fachgebundene Hochschulreife**, Fachoberschule Bamberg (tech. branch), Seminar work: “*Logarithmus- und Exponentialrechnung im Komplexen*”.

Professional Experience

- since October 2021 Postdoctoral Researcher at the Humboldt University of Berlin with Prof. Ulrich Horst in the research group “*Applied Financial Mathematics & Applied Stochastic Analysis*”.
- April 2019 - September 2021 Scientific Assistant at the Technical University of Berlin in the MATH+ project AA4-2 “*Optimal control in energy markets using rough analysis and deep networks*”.
- October 2017 - March 2019 Student job at Digitec GmbH, Hamburg, researching and developing software for interest rate term structure modelling with multiple yield curves.
- April 2017 - September 2017 Student job at Onwrks (StarTUp Incubator), Berlin, developing statistical and machine learning methods for maintenance prediction of wind turbines.

Prices

July 2022 MATH+ Dissertation Award

Current Research Interest

- Rough path signatures and their applications in stochastic control and machine learning.
- Stochastic optimization problems in financial and energy markets.
- Fractional Brownian motion, log-correlated fields, Gaussian multiplicative chaos and their applications to volatility modelling.

Research Publications

Preprints

- [5] C. Bayer, P. Hager, S. Riedel, and J. Schoenmakers. “Optimal stopping with signatures”. In: *arXiv e-prints*, arXiv:2105.00778 (May 2021). <https://arxiv.org/abs/2105.00778> (to appear in the *Annals of Applied Probability*)
- [4] C. Bayer, D. Belomestny, P. Hager, P. Pigato, J. Schoenmakers, and V. Spokoiny. “Reinforced optimal control”. In: *arXiv e-prints*, arXiv:2011.12382 (Nov. 2020). <http://arxiv.org/abs/2011.12382> (to appear in the *Communications in Mathematical Sciences*)

Publications in Peer Reviewed Journals

- [3] P. K. Friz, P. P. Hager, and N. Tapia. “Unified signature cumulants and generalized Magnus expansions”. In: *Forum of Mathematics, Sigma* 10 (2022), e42
- [2] P. Hager and E. Neuman. “The multiplicative chaos of $H = 0$ fractional Brownian fields”. In: *The Annals of Applied Probability* 32.3 (2022), pp. 2139–2179
- [1] C. Bayer, D. Belomestny, P. Hager, P. Pigato, and J. Schoenmakers. “Randomized Optimal Stopping Algorithms and Their Convergence Analysis”. In: *SIAM Journal on Financial Mathematics* 12.3 (2021), pp. 1201–1225

Teaching Experience

Fall 2022/23	Lecture on Discrete Time Finance
Spring 2022	Lecture on Continuous Time Finance
Fall 2021/22	Exercise Class on Analysis III for Physicists
Fall 2016/2017	Tutorial on Linear Algebra I for Engineers.
Spring 2016	Tutorial on Stochastics for Computer scientist.
Fall 2015/2016	Tutorial on Linear Algebra I for Engineers.

Talks

- “A Mean Field Game of Optimal Portfolio Liquidation with Short Sale Constraint”:
 - August 29th, 2022, Workshop on Many Player Games and Applications, Humboldt University of Berlin.
- “Mini-Course on Machine Learning Methods in Finance - Lecture on Deep Signature Stopping”:
 - May 23rd, 2022, Stochastic Numerics Meeting, KAUST.
- “Optimal Stopping with Signatures – Reinforced Optimal Control”:
 - December 1, 2021, DataSig Research Seminar, (online), University of Oxford / Imperial College London.
- “Optimal Stopping with Signatures”:
 - September 15, 2022, DMV Annual Meeting, Free University of Berlin,
 - September 7, 2022, New interfaces of Stochastic Analysis and Rough Paths, (remote), Banff,
 - November 10, 2021, Math+ Spotlight Talk (online), Berlin,
 - August 25, 2021, Berlin Workshop for Young Researchers on Mathematical Finance (online conference), Humboldt University of Berlin,
 - June 10, 2021, Big Data and Machine Learning in Finance Conference (online), Politecnico di Milano,
 - May 11, 2021, Seminar “Modern Methods in Applied Stochastics and Nonparametric Statistics”, WIAS Berlin,
 - March 3, 2021, BMS Student Conference (online), Berlin Mathematical School,

- January 29, 2021, XXII Workshop On Quantitative Finance (online), University of Verona.
- “*The Multiplicative Chaos of $H=0$ fractional Brownian Fields*”:
 - June 4, 2021, SIAM Conference on Financial Mathematics and Engineering (online), SIAM Philadelphia.
- “*Unified Signature Cumulants and Generalized Magnus Expansions*”:
 - May 12th, 2022, 15th Oxford-Berlin Young Researchers Meeting on Applied Stochastic Analysis, WIAS Berlin,
 - February 24, 2021, Cumulants in Stochastic Analysis (online), TU Berlin,
 - February 11, 2021, 14th Oxford-Berlin Young Researchers Meeting on Applied Stochastic Analysis (online), University of Oxford,
 - August 25, 2020, Bernoulli-IMS One World Symposium (pre-recorded talk),
 - June 9, 2020, 13th Berlin-Oxford Young Researchers Meeting on Applied Stochastic Analysis (online), WIAS Berlin.
- “*Reinforced Optimal Control*”:
 - July 7, 2020, Seminar “Modern Methods in Applied Stochastics and Nonparametric Statistics”, WIAS Berlin.
- “*What is Gaussian multiplicative chaos?*”:
 - Jan 1, 2020, “What is ...? Seminar”, Berlin Mathematical School.
- “*The Multiplicative Chaos of Fractional Brownian Motions with Vanishing Hurst Parameters*”:
 - December 5, 2019, 12th Oxford-Berlin Young Researchers Meeting on Applied Stochastic Analysis, University of Oxford.
 - June 26, 2019, Seminar “Finance and Stochastics”, Imperial College London,
 - May 29, 2019, Seminar “Modern Methods in Applied Stochastics and Nonparametric Statistics”, WIAS Berlin.

Miscellaneous

Languages	German (mother tongue), English (fluent), Italian (intermediate).
Programming Languages	Python, Cython, Scala.
Memberships	MATH+ postdoctoral member.
Referee Activity	For the <i>Annals of Applied Probability</i> and the Journal of <i>Mathematical Finance</i> .