

# Paul Peter Hager

## Curriculum Vitae

Humboldt University Berlin  
Department of Mathematics  
Unter den Linden 6  
10099 Berlin

December 8, 2021

### Education

- April 2019 **Dr. rer. nat.**, Technische Universität Berlin / Berlin Mathematical  
- September 2021 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 **Master of Science**, Technische Universität Berlin  
- March 2019 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 **Bachelor of Science**, Technische Universität Berlin,  
- March 2016 Mathematics with emphasis on probability theory,  
Thesis: “*Bayesian Change Point Detection with an Asymmetric Miss  
Criterion*”, supervision by Prof. P. Bank.
- September 2009 **Fachgebundene Hochschulreife**, Fachoberschule Bamberg (tech.  
- August 2012 branch),  
Seminar work: “*Logarithmus- und Exponentialrechnung im Komplexen*”.

### Professional Experience

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

### Teaching Experience

- Fall 2021/22 Exercise Class in Analysis III for Physicists
- Fall 2015/2016 Tutorial in Linear Algebra I for Engineers.
- Spring 2016 Tutorial in Stochastics for Computer scientist.
- Fall 2016/2017 Tutorial in Linear Algebra I for Engineers.

### Current Research Interest

- Signatures and their applications in stochastic control and machine learning.
- Fractional Brownian motion, log-correlated fields, Gaussian multiplicative chaos and their applications to volatility modelling.

## Research Publications

- (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

## Preprints

- (4) 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>
- (3) P. K. Friz, P. Hager, and N. Tapia. “Unified Signature Cumulants and Generalized Magnus Expansions”. In: *arXiv e-prints*, arXiv:2102.03345 (Feb. 2021). <https://arxiv.org/abs/2102.03345>
- (2) 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>
- (1) P. Hager and E. Neuman. “The Multiplicative Chaos of  $H = 0$  Fractional Brownian Fields”. In: *arXiv e-prints*, arXiv:2008.01385 (Aug. 2020). <https://arxiv.org/abs/2008.01385> (accepted at the *Annals of Applied Probability*)

## Talks

- “*Optimal Stopping with Signatures – Reinforced Optimal Control*”:
  - December 1, 2021, DataSig Research Seminar, (online talk), University of Oxford / Imperial College London.
- “*Optimal Stopping with Signatures*”:
  - November 10, 2021, Math+ Spotlight Talk, (online talk), 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 conference), Politecnico di Milano,
  - May 11, 2021, Seminar “Modern Methods in Applied Stochastics and Nonparametric Statistics”, WIAS Berlin,
  - March 3, 2021, BMS Student Conference (online conference), Berlin Mathematical School,
  - January 29, 2021, XXII Workshop On Quantitative Finance (online conference), University of Verona.
- “*The Multiplicative Chaos of  $H=0$  fractional Brownian Fields*”:
  - June 4, 2021, SIAM Conference on Financial Mathematics and Engineering (online conference), SIAM Philadelphia.
- “*Unified Signature Cumulants and Generalized Magnus Expansions*”:
  - February 24, 2021, Cumulants in Stochastic Analysis (online conference), TU Berlin,
  - February 11, 2021, 14th Oxford-Berlin Young Researchers Meeting on Applied Stochastic Analysis (online conference), 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 conference), 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 (beginner).
Programming Languages	Python, Cython, Scala.
Referee Activity	For the <i>Annals of Applied Probability</i> and the Journal of <i>Mathematical Finance</i> .