David Berghaus

CV

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Education

2021–2023 **PhD in Mathematical Physics / Computational Number Theory** , *Rheinische Friedrich-Wilhelms-Universität*, Bonn

- Thesis: *On the Numerical Computation of Modular Forms*,
  Grade: Magna Cum Laude (very good) [Link]
- Development of numerical algorithms for number theory [Code] (Python, Cython, C)
- Creation of databases for special mathematical objects [Code1, Code2] (Python)

2018–2020 **M. Sc. in Physics**, *Rheinische Friedrich-Wilhelms-Universität*, Bonn, *Grade: 1.4*

- Thesis: *Computing Laplacian Eigenvalues at Arbitrary Precision Arithmetic*,
  Grade: 1.0 (very good)
- Distinguished with the Bonn-Cologne Graduate School (BCGS) Honors Branch scholarship for excellent academic achievements

2015–2018 **B. Sc. in Physics**, *Rheinische Friedrich-Wilhelms-Universität*, Bonn, *Grade: 1.7*

- Thesis: *Laplacian eigenvalues of regular polygons and their relation to multiple zeta values*,
  Grade: 1.0 (very good)

Professional Experience

2023–current **Research Scientist**, *Fraunhofer IAIS*, Sankt Augustin

Doing research and industry work in the fields of time series and natural language processing.
Industry Projects: (for an overview of research works, see the publications below)

- Development of an LLM that is fine-tuned for german legal tasks
- Automated email order processing for a client using LLMs
- Client acquisition talks with various companies and general consulting on workflow optimization using AI

2019–2023 **IT Research Assistant**, *Physikalisches Institut*, Bonn

Work in the IT department.
Projects:

- Conception, planning and development of new room-booking and event-management software based on Indico
- Automated installation and maintenance of windows and macOS machines
- Evaluation and documentation of various software

2018–2019 **Student Assistant**, *Physikalisches Institut*, Bonn

Shift work as a student operator at the ELSA particle accelerator

2016–2019 **Startup Founder**, *Ems und Berghaus App-Entwicklung GbR*, Bonn
Development of a social media app for finding nearby events

- Project lead and supervision of freelance designers and developers
- Conception
- Development of the first version in android

Selected Publications

- *Foundation Inference Models for Stochastic Differential Equations: A Transformer-based Approach for Zero-shot Function Estimation* (with P. Seifner, K. Cvejoski, C. Ojeda, R. Sanchez), SUBMITTED TO NEURIPS, 2025
- *Not constructing Ramsey Graphs using Deep Reinforcement Learning* ICLR ICBINB, 2025
- *Foundation Inference Models for Markov Jump Processes* (with K. Cvejoski, P. Seifner, C. Ojeda, R. Sanchez), NEURIPS, 2024
- *Advancing Personalized Medicine: A Scalable LLM-based Recommender System for Patient Matching* (with A. Berger, A. Bashir, et al), IEEE BIG DATA, 2024
- *Advancing Risk and Quality Assurance: A RAG Chatbot for Improved Regulatory Compliance* (with L. Hillebrand, A. Berger, D. Uedelhoven, et al), IEEE BIG DATA, 2024
- *Fine-Tuning Large Language Models for Compliance Checks* (with T. Bell, D. Leonhard, A. Bashir, et al), IEEE BIG DATA, 2024
- *Computation of Laplacian eigenvalues of two-dimensional shapes with dihedral symmetry* (with R.S. Jones, H. Monien and D. Radchenko), ADVANCES IN COMPUTATIONAL MATHEMATICS, 2022
- *On the computation of modular forms on noncongruence subgroups* (with H. Monien and D. Radchenko), MATHEMATICS OF COMPUTATION, 2022
- *On Dirichlet eigenvalues of regular polygons* (with B. Georgiev, H. Monien and D. Radchenko), JOURNAL OF MATHEMATICAL ANALYSIS AND APPLICATIONS, 2021

Technical Knowledge

Python	Advanced	**Julia**	Advanced
Cython	Advanced	**C/C++**	Basic knowledge
Git/GitHub	Advanced	**LaTeX**	Basic knowledge
Linux	Basic knowledge	**Windows**	Basic knowledge

Languages

German	Native	**English**	Fluent
French	Basic knowledge		

Certificates

Coursera	Deep Learning Specialization	Coursera	DeepLearning.AI TensorFlow Developer Specialization
Coursera	Introduction to Machine Learning in Production	Coursera	Applied Machine Learning in Python