# Jan Philipp Bauer

japhba.github.io

## Education

**Ph.D. student** in theoretical neuroscience 10/2022–10/2026

Gatsby Unit, University College London, United Kingdom

Edmond and Lily Safra Center, The Hebrew University of Jerusalem, Israel

*Working on kernel descriptions of chaos in recurrent models of the brain.*

**Advisors:** Jonathan Kadmon and Agostina Palmigiano

**Research stay** 11/2023–04/2024

Summerfield lab, University of Oxford, United Kingdom

*Modelled cognitive flexibility with linear neural networks.*

**M.Sc.** in physics **GPA** 1.0/1.0, with distinction 2019–2022

RWTH Aachen University, Germany

*Focussed coursework on Statistical Mechanics of Neural Networks, Theoretical Neuroscience, Deep Learning in Physics Research, Quantum Information, and Computational Physics*

**Master's thesis** 09/2021–08/2022

Juelich Research Center, Germany

*Analysis of computation in cortical networks by Gaussian process regression.*

**Advisors:** Prof. Moritz Helias, Dr. Christian Keup (now EPFL Switzerland)

**Bilateral graduate exchange program** 09/2019–03/2020

The University of Tokyo, Japan

*Focussed coursework on Tensor Networks and Universal Biology, which investigates stem cell differentiation and evolution by a mathematical, complex systems approach. Member of Japanese university choir "The White Rose".*

**B.Sc.** in physics **GPA** 1.3/1.0, with distinction 10/2016–09/2019

RWTH Aachen University, Germany

**Bachelor's thesis** 03/2019–09/2019

Juelich Research Center, Germany

*Description of unsupervised learning in Boltzmann machines via Feynman diagrams.*

**Advisors:** Prof. Moritz Helias, Dr. Tobias Kuehn (now ENS Paris)

4x **teaching assistant** in theoretical physics and lab courses, mentoring 1$^{st}$ to 10$^{th}$ semester students.

## Publications

Sandbrink, K.*, **Bauer, J.P.***, Proca, A.M.*, Saxe, A.M., Summerfield, C. and Hummos, A.*, 2024. *Flexible task abstractions emerge in linear networks with fast and bounded units.* **NeurIPS 2024 Spotlight.**

## Professional experience

**PIBBSS Fellowship** 06/2024–09/2024

London Initiative for AI Safety, London, United Kingdom

*Project on mechanistic interpretability of in-context learning.*
**Advisor:** Jan Hendrik Kirchner

**Research Internship** 03/2021–06/2021

Bosch Center for Artificial Intelligence, Renningen, Germany

*Co-developed and implemented architectural extensions of Bayesian version of the Neural Process model.*
**Advisor:** Michael Volpp

## Honours

**HUJI International PhD Talent Scholarship** since 2023

**Springorum memorial coin for outstanding graduates** 2022

**Scholarship fellow of the Konrad Adenauer Foundation** (one of 13 academic talent promoters established by the Federal Ministry of Education and Research) 2016-2022

Fellow of RWTH Aachen University's **Dean's List** of top 5% students since 2019

**Valedictorian** in Abitur A-Levels 2016

## Presentations

Poster **Recurrent networks under constraint of sparse reward learn interacting belief state dynamics**, COSYNE 2024, Lisbon, Portugal 03/2024

Talk **Can discrete neurons be useful?**, ELSC Annual Retreat, Nahsholim, Israel 06/2023

Poster **Discrete communication mediates effective regularization in chaotic recurrent networks**, COSYNE 2023, Montréal, Canada 03/2023

**Random Matrix Theory for Machine Learning**, Parallel Sessions of INM-6 Annual Retreat 05/2022

**Inference with Graphical Models**, Book Club of Institute for Neuroscience and Medicine, Juelich Research Center 10/2021

**Proof-read and advised high school textbook** together with teacher Dr. Bardo Diehl at didactics congress MNU Aachen in front of 40 participants *("Zentrale Experimente für das Abitur", Cornelsen 2017)* 04/2017

## Schools & Workshops

**12-day workshop** "Analytical Connectionism" 09/2023
University College London, United Kingdom

**3-week summer school** "Mathematical Methods in Computational Neuroscience" 07/2023
NTNU, Norway

**5-day workshop** "Recent advances in understanding artificial and biological neural networks" 02/2023
Les Houches School of Physics, France

**5-day summer school** "Reinforcement Learning" 06/2022
Vrije Universiteit Amsterdam

## Teaching Experience

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| Statistical Physics and Field Theory | summer 2022 |
| Theory of Electromagnetism | winter 2022 |
| Preparatory math course for computer scientists | 10/2020 |
| Theory of Thermodynamics | winter 2020 |
| Introductory lab course for physicists | 09/2018 |
| Introduction to Theoretical Physics ($1^{st}$ year B.Sc.) | winter 2018 |

## Leadership and Outreach

**Social commitment**

Volunteer at the City of Aachen, supporting Egyptian family with homework and administrative tasks 2017–2020

Co-organisation of "LernFair"-AI lessons, part of a project aimed at high school students during the pandemic winter 2021

**Full-time scholarship by the Konrad Adenauer Foundation** 2016–2022

Elected **spokesperson** of local group of 25 students 2019–2020

Increased participation of students by bundling proposals for engaging and meaningful group activities, such as a volunteer week in kindergarten in socially deprived suburb of Aachen

Initiated and organized **4-day seminar on the scientific voice in democracies**, with invited speakers on the philosophy of science, politics, recent societal challenges, and science communication 04/2022

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|---|---|
| Service to inform about cancellation of school lessons in the early morning before classes start | 2015 |
| Development of mobile app to create a precise elevation map of Aachen by use of barometer data of phones, targeted at finding a least elevation bicycle route | 2016 |
| Application of machine learning and Fourier decomposition to successfully remove chequered paper background from handwritten lecture notes | 2020 |

## Software and Language Proficiency

**Software**

Python, JAX, PyTorch

3D computer graphics with Blender

**Languages**

German (native)

English (academic proficiency, daily usage)

French (good, DELF A2)

Japanese (good, weekly practice with Tandem partner)

## Recreational Activities

Bicycle touring and medium distance running (olympic-distance triathlon in September 2022)

Singing in university choir (tenor voice)

## References

**Dr. Jonathan Kadmon**, Ph.D. advisor, The Hebrew University of Jerusalem

**Prof. Moritz Helias**, M.Sc. thesis advisor, Juelich Research Center

**Dr. Michael Volpp**, research internship advisor, Bosch Center for Artificial Intelligence

**Dr. Christian Keup**, M.Sc. thesis advisor, EPFL

**Dr. Tobias Kuehn**, B.Sc. thesis advisor, Ecole Normale Supérieure Paris

*Updated: January 21, 2025*