

JOHANN BREHMER

Machine learner and physicist

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RESEARCH INTERESTS

- Geometry + ML: Equivariant architectures, scalable strong priors, generative models
- Simulators + ML: Simulation-based inference, neural surrogates, ML for physics
- Causality + interactivity + ML: Non-iid situations, offline reinforcement learning, skill learning

EXPERIENCE

Qualcomm AI Research Amsterdam, Netherlands

Research scientist (Senior Staff Engineer) 11/2023 – now
Research scientist (Staff Engineer) 01/2021 – 11/2023

- Topics: Geometric deep learning, diffusion models, causality, offline RL, skill learning
- Roles: Researcher, supervisor, team lead (3 team members), manager (2 reports)
- Key collaborators: Taco Cohen, Pim de Haan

New York University, USA

Moore-Sloan postdoctoral researcher 09/2017 – 12/2020

- Topics: Simulation-based inference, normalizing flows, machine learning for physics
- Roles: Researcher, supervisor
- Key collaborators: Kyle Cranmer, Gilles Louppe

Heidelberg University, Germany

PhD candidate 07/2014 – 08/2017

- Topics: Statistics for particle physics, effective field theories, Higgs boson measurements
- Roles: Researcher, co-supervisor, (head) teaching assistant
- PhD advisor: Tilman Plehn

CERN, Geneva

Summer student 06/2012 – 09/2012

- Topic: Machine learning for particle physics
- Supervisor: Johannes Albrecht

EDUCATION

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|------------------|------------------------------|------------------|-------------------|
| PhD in Physics | Heidelberg University | summa cum laude* | 07/2014 – 08/2017 |
| MSc in Physics | Heidelberg University | 1.0* | 02/2012 – 06/2014 |
| BSc in Physics | Heidelberg University | 1.0* | 09/2008 – 02/2012 |
| Visiting student | Imperial College, London, UK | 1.0* | 09/2010 – 07/2011 |
| Abitur | Heidelberg University | 1.0* | 06/2007 |

*German grading scale: from 1.0 (best) to 6.0 (worst); PhD grades: from summa cum laude (best) to rite (worst)

PUBLICATION OVERVIEW

- 44 publications with 4198 citations, h-index of 21 ([Google Scholar](https://scholar.google.com/citations?user=...) as of January 1, 2024)
- 17 first-author papers accepted in top venues including PRL, PNAS, NeurIPS

SELECTED PUBLICATIONS

GEOMETRY + ML

[Geometric algebra transformer](#)

[Equivariant diffusion for planning w/ embodied agents](#)

[Euclidean, projective, conformal: ...](#)

[Flows for simult. manifold learning & density estimation](#)

[Neural message passing for jet physics](#)

Brehmer, de Haan, Behrends, Cohen NeurIPS 23

Brehmer, Bose, de Haan, Cohen NeurIPS 23

de Haan, Cohen, **Brehmer** Workshop 23

Brehmer, Cranmer NeurIPS 20

Henrion, **Brehmer**, Bruna, Cho, ... Workshop 17

CAUSALITY + INTERACTIVITY + ML

[Weakly supervised causal representation learning](#)

[Deconfounded imitation learning](#)

[Hierarchical clustering in particle physics through RL](#)

Brehmer, de Haan, Lippe, Cohen NeurIPS 22

Vuorio, de Haan, **Brehmer**, ..., Cohen Workshop 22

Brehmer, Macaluso, ..., Cranmer Workshop 20

SCIENTIFIC SIMULATORS + ML

[Simulation-based inference for particle physics](#)

[Stronger symbolic summary statistics for the LHC](#)

[The frontier of simulation-based inference](#)

[MadMiner: ML-based inference for particle physics](#)

[Mining implicit models for likelihood-free inference](#)

[Inferring subhalo population properties with ML](#)

[Constraining effective field theories with ML](#)

[Guide to constraining EFTs with ML](#)

[Better Higgs-CP tests w/ information geometry](#)

[Better Higgs measurements w/ information geometry](#)

Brehmer, Cranmer Book chapter 22

Soybelman, Butter, Plehn, **Brehmer** Workshop 22

Cranmer, **Brehmer**, Louppe PNAS 20

Brehmer, Kling, Espejo, Cranmer CSBS 20

Brehmer, Louppe, Pavez, Cranmer PNAS 20

Brehmer, Mishra-Sharma, ..., Cranmer AstrJ 19

Brehmer, Cranmer, Louppe, Pavez PRL 18

Brehmer, Cranmer, Louppe, Pavez PRD 18

Brehmer, Kling, Plehn, Tait PRD 18

Brehmer, Cranmer, Kling, Plehn PRD 17

OTHER

[Instance-adaptive video compression](#)

[Pushing Higgs Effective Theory to its limits](#)

van Rozendaal, **Brehmer**, ..., Cohen TMLR 23

Brehmer, Freitas, Lopez-Val, Plehn PRD 16

ACCOMPLISHMENTS

Speaker: **26** invited talks (**42** total) at international conferences / seminars
Keynote speaker at ACAT 2019

Open source: Lead developer of the [MadMiner](#) library

Organizer: Seminars, workshops, conferences with up to 150 participants, including CLear 2023

Member: ELLIS

Awards: PRL Editor's Suggestion
1 oral + 1 spotlight at workshops
Top Reviewer at NeurIPS 2023
Otto Haxel prize for best MSc thesis (out of 150)
Prestigious German Studienstiftung scholarship (top 0.5% of all German students)

Press coverage: [TWIML](#) podcast, [Physics](#), [phys.org](#), [Frankfurter Allgemeine Zeitung](#)

SKILLS

Technical: Python, PyTorch, git, Docker, SLURM

Leadership: Team leadership, people management, project management, conference organization, hiring pipeline design, hiring, grassroots diversity initiative

Communication: Technical writing, LaTeX, data visualization, presentations to experts and non-experts, teaching

Languages: German (native), English (fluent), Dutch (advanced)