JOHANN **BREHMER**

Machine learner and physicist

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RESEARCH INTERESTS

- Geometry + ML: Equivariance, scalability of strong priors, diffusion models, normalizing flows
- Causality + interactivity + ML: Non-iid situations, offline reinforcement learning, skill learning
- Scientific simulators + ML: Simulation-based / likelihood-free inference, AI for science

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

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 as of January 1, 2024)
- **17** first-author papers accepted in top venues including PRL, PNAS, NeurIPS

SELECTED PUBLICATIONS

GEOMETRY + ML

Geometric algebra transformer	**Brehmer**, de Haan, Behrends, Cohen	NeurIPS 23
Equivariant diffusion for planning w/ embodied agents	**Brehmer**, Bose, de Haan, Cohen	NeurIPS 23
Euclidean, projective, conformal: …	de Haan, Cohen, **Brehmer**	Workshop 23
Flows for simult. manifold learning & density estimation	**Brehmer**, Cranmer	NeurIPS 20
Neural message passing for jet physics	Henrion, **Brehmer**, Bruna, Cho, …	Workshop 17

CAUSALITY + INTERACTIVITY + ML

Weakly supervised causal representation learning	**Brehmer**, de Haan, Lippe, Cohen	NeurIPS 22
Deconfounded imitation learning	Vuorio, de Haan, **Brehmer**, …, Cohen	Workshop 22
Hierarchical clustering in particle physics through RL	**Brehmer**, Macaluso, …, Cranmer	Workshop 20

SCIENTIFIC SIMULATORS + ML

Simulation-based inference for particle physics	**Brehmer**, Cranmer	Book chapter 22
Stronger symbolic summary statistics for the LHC	Soybelman, Butter, Plehn, **Brehmer**	Workshop 22
The frontier of simulation-based inference	Cranmer, **Brehmer**, Louppe	PNAS 20
MadMiner: ML–based inference for particle physics	**Brehmer**, Kling, Espejo, Cranmer	CSBS 20
Mining implicit models for likelihood-free inference	**Brehmer**, Louppe, Pavez, Cranmer	PNAS 20
Inferring subhalo population properties with ML	**Brehmer**, Mishra-Sharma, …, Cranmer	AstrJ 19
Constraining effective field theories with ML	**Brehmer**, Cranmer, Louppe, Pavez	PRL 18
Guide to constraining EFTs with ML	**Brehmer**, Cranmer, Louppe, Pavez	PRD 18
Better Higgs-CP tests w/ information geometry	**Brehmer**, Kling, Plehn, Tait	PRD 18
Better Higgs measurements w/ information geometry	**Brehmer**, Cranmer, Kling, Plehn	PRD 17

OTHER

Instance-adaptive video compression	van Rozendaal, **Brehmer**, …, Cohen	TMLR 23
Pushing Higgs Effective Theory to its limits	**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)