

JOHANN BREHMER

Machine learner and physicist

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RESEARCH INTERESTS

- Simulators + ML: Inverse problems, neural surrogates, simulation-based inference
- Geometric deep learning: Scalable equivariant architectures, generative models
- Interactive learning: Learning from non-iid data, causality, reinforcement learning

EXPERIENCE

CuspAI, Netherlands

Research scientist (Member of Technical Staff) 08/2024 – now

- Mission: Machine learning-driven material discovery for carbon capture
- Role: Researcher, member of initial scientific team
- Key collaborators: Max Welling

Qualcomm AI Research Amsterdam, Netherlands

Research scientist (Senior Staff Engineer / Manager) 02/2024 – 08/2024

Research scientist (Senior Staff Engineer) 11/2023 – 02/2024

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

- Topics: Geometric deep learning, diffusion models, causality, offline RL, applications in robotics
- Roles: Researcher, team lead (team of 3), manager (6 reports), intern supervisor (3 interns)
- 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 particle physics
- Roles: Researcher, supervisor
- Key collaborators: Kyle Cranmer, Gilles Louppe

Heidelberg University, Germany

PhD candidate 07/2014 – 08/2017

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

CERN, Switzerland

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

- 45 publications with 4940 citations, h-index of 22 (Google Scholar as of August 25, 2024)
- 17 first-author papers accepted in top venues including PRL, PNAS, NeurIPS

SELECTED PUBLICATIONS

GEOMETRIC DEEP LEARNING

Lorentz-equivariant geom. algebra transformer	Spinner, Bresó, ..., Brehmer	Under review
Euclidean, projective, conformal: ...	de Haan, Cohen, Brehmer	AISTATS 24
Geometric algebra transformer	Brehmer , de Haan, Behrends, Cohen	NeurIPS 23
Equivariant diffusion for planning w/ embodied agents	Brehmer , Bose, de Haan, Cohen	NeurIPS 23
Flows for simult. manifold learning & density estimation	Brehmer , Cranmer	NeurIPS 20
Neural message passing for jet physics	Henrion, Brehmer , Bruna, Cho, ...	Workshop 17

SIMULATORS + ML

Back to the formula-LHC edition	Butter, Plehn, Soybelman, Brehmer	SciPost 24
Simulation-based inference for particle physics	Brehmer , Cranmer	Book chapter 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

CAUSALITY & INTERACTIVE LEARNING

Deconfounded imitation learning	Vuorio, de Haan, Brehmer , ..., Cohen	TMLR 24
Weakly supervised causal representation learning	Brehmer , de Haan, Lippe, Cohen	NeurIPS 22
Hierarchical clustering in particle physics through RL	Brehmer , Macaluso, ..., Cranmer	Workshop 20

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

Organizer:	Seminars, workshops, conferences with up to 150 participants, including CLear 2023
Speaker:	29 invited talks (45 total) at international conferences / seminars Keynote speaker at ACAT 2019
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

Leadership:	Team leadership, people management, project management, conference organization, hiring pipeline design, interviewing, grassroots diversity initiative
Technical:	Python, PyTorch, git, Docker, SLURM
Communication:	Technical writing, data visualization, presentations to experts and non-experts, teaching
Languages:	German (native), English (fluent), Dutch (advanced)