JOHANN **BREHMER**

Machine learner and physicist

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INTERESTS

- ML for materials and molecules
- Generative models
- Simulators + ML (e.g. inverse problems)
- Geometric deep learning

EXPERIENCE

CuspAI, Netherlands

Member of Technical Staff   08/2024 – now
- Mission: Material discovery with molecular simulation & machine learning, e.g. for carbon capture
- Role: Researcher, member of initial scientific team, project lead
- Key collaborators: Max Welling

Qualcomm AI Research Amsterdam, Netherlands

Senior Staff Engineer / Manager   02/2024 – 08/2024
Senior Staff Engineer   11/2023 – 02/2024
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

- **51** publications with **5433** citations, h-index of **24**   (<ins>Google Scholar</ins> as of December 22, 2024)
- **17** first-author papers accepted in top venues including PRL, PNAS, NeurIPS

SELECTED PUBLICATIONS

GEOMETRIC DEEP LEARNING

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

SIMULATORS + ML

<ins>Back to the formula–LHC edition</ins>	Butter, Plehn, Soybelman, **Brehmer**	SciPost 24
<ins>Simulation-based inference for particle physics</ins>	**Brehmer**, Cranmer	Book chapter 22
<ins>The frontier of simulation-based inference</ins>	Cranmer, **Brehmer**, Louppe	PNAS 20
<ins>MadMiner: ML–based inference for particle physics</ins>	**Brehmer**, Kling, Espejo, Cranmer	CSBS 20
<ins>Mining implicit models for likelihood-free inference</ins>	**Brehmer**, Louppe, Pavez, Cranmer	PNAS 20
<ins>Inferring subhalo population properties with ML</ins>	**Brehmer**, Mishra-Sharma, …, Cranmer	AstrJ 19
<ins>Constraining effective field theories with ML</ins>	**Brehmer**, Cranmer, Louppe, Pavez	PRL 18
<ins>Guide to constraining EFTs with ML</ins>	**Brehmer**, Cranmer, Louppe, Pavez	PRD 18
<ins>Better Higgs-CP tests w/ information geometry</ins>	**Brehmer**, Kling, Plehn, Tait	PRD 18
<ins>Better Higgs measurements w/ information geometry</ins>	**Brehmer**, Cranmer, Kling, Plehn	PRD 17

CAUSALITY & INTERACTIVE LEARNING

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

OTHER

<ins>Instance-adaptive video compression</ins>	van Rozendaal, **Brehmer**, …, Cohen	TMLR 23
<ins>Pushing Higgs Effective Theory to its limits</ins>	**Brehmer**, Freitas, Lopez-Val, Plehn	PRD 16

ACCOMPLISHMENTS

Organizer:	Conferences, workshops, seminars 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:	Best paper award at NeurIPS NeurReps workshop 2024 PRL Editor's Suggestion 2018 2 orals + 1 spotlight at workshops (2020 – 2024) 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:	<ins>TWIML podcast</ins>, <ins>Physics</ins>, <ins>phys.org</ins>, <ins>Frankfurter Allgemeine Zeitung</ins>

SKILLS

Leadership:	Team leadership, people management, conference organization, hiring pipelines design, technical interviews, grassroots diversity initiative
Technical:	Python, PyTorch, git, Docker, Kubernetes, SLURM
Languages:	German (native), English (fluent), Dutch (advanced)