

# Melanie Weber

## Education

Princeton University, Ph.D. in Applied Mathematics (advisor: Charles Fefferman)	2021
University of Leipzig, B.Sc./M.Sc. in Mathematics	2016

## Appointments

Assistant Professor, Applied Mathematics and Computer Science, Harvard University	2023-
Hooke Research Fellow, Mathematical Institute, University of Oxford	2021-22
Research Fellow, Simons Institute for the Theory of Computing, Berkeley	2021

## Honors and Awards

Airforce Young Investigator Award	2025
Aramont Fellowship for Emerging Science Research	2025
Alfred P. Sloan Research Fellow in Mathematics	2024
AAAI New Faculty Highlights	2024
IMA Leslie Fox Prize in Numerical Analysis	2023
Simons-Berkeley Fellowship, Simons Foundation	2021
Hooke Fellowship, University of Oxford	2021
C. V. Starr Fellowship, Princeton University	2016

## Selected Work

( $\alpha$ - $\beta$ ) indicates authors listed alphabetically; \* indicates equal contribution; + indicates an advisee/mentee.

M. Hehl<sup>+</sup>, M.-K. von Renesse, M. Weber (2025): Neural Feature Geometry evolves as discrete Ricci Flow. *Under Review*. arXiv:2509.22362

R. Pellegrin<sup>+,\*</sup>, L. Fesser<sup>+,\*</sup>, M. Weber (2025): Higher-Order Learning with Graph Neural Networks via Hypergraph Encodings. *Advances in Neural Information Processing Systems (NeurIPS)*.

A. Lee, M. Weber, F. Viegas, M. Wattenberg (2025): Shared Global and Local Geometry of Language Model Embeddings. *Conference on Language Modeling (COLM)*.

Z. Shumaylov, P. Zaika, J. Rowbottom, F. Sherry, M. Weber, C.-B. Schönlieb (2025): Lie Algebra Canonicalization: Equivariant Neural Operators under arbitrary Lie Groups. *International Conference on Learning Representations (ICLR)*

Y. Tian<sup>\*,+</sup>, Z. Lubberts<sup>\*</sup>, M. Weber (2025): Curvature-based Clustering on Graphs. *Journal of Machine Learning Research*

B. Kiani<sup>+</sup>, L. Fesser<sup>+</sup>, M. Weber (2024): Unitary Convolutions for Learning on Graphs and Groups. *Advances in Neural Information Processing Systems (NeurIPS)*, spotlight (top 3% submissions)

B. Kiani<sup>+</sup>, J. Wang<sup>+</sup>, M. Weber (2024): Hardness of Learning Neural Networks under the Manifold Hypothesis. *Advances in Neural Information Processing Systems (NeurIPS)*, spotlight (top 3% submissions)

A. Cheng<sup>\*,+</sup>, V. Dixit<sup>\*</sup>, M. Weber (2024): Disciplined Geodesically Convex Programming. arXiv:2407.05261

B. Kiani<sup>\*,+</sup>, T. Le<sup>\*</sup>, H. Lawrence<sup>\*</sup>, S. Jegelka, M. Weber (2024): On the Hardness of Learning under Symmetries. *International Conference on Learning Representations (ICLR)*, spotlight (top 5% submissions)

L. Fesser<sup>+</sup>, M. Weber (2024): Effective Structural Encodings via Local Curvature Profiles. *International Conference on Learning Representations (ICLR)*

L. Fesser<sup>+</sup>, M. Weber (2023): Mitigating Over-smoothing and Over-squashing using Augmentations of Forman-Ricci Curvature. *Learning on Graphs Conference (LoG)*.

( $\alpha$ - $\beta$ ) N. Garcia Trillos, M. Weber (2023): Continuum Limits of Ollivier's Ricci Curvature on data clouds: pointwise consistency and global lower bounds. arXiv:2307.02378

M. Weber, S. Sra (2023): Global optimality for Euclidean CCCP under Riemannian convexity. *International Conference on Machine Learning (ICML)*

M. Weber, S. Sra (2022): Riemannian Optimization via Frank-Wolfe Methods. *Mathematical Programming*

( $\alpha$ - $\beta$ ) J. Carruth, M. Eggli, C. Fefferman, C. Rowley, M. Weber (2022): Controlling Unknown Linear Dynamics with Bounded Multiplicative Regret. *Revista Matemática Iberoamericana*, vol. 38 (7), 2185–2216.

M. Weber, S. Sra (2021): Projection-free nonconvex stochastic optimization on Riemannian manifolds. *IMA Journal on Numerical Analysis*, vol 42(4), pages 3241–3271.

( $\alpha$ - $\beta$ ) C. Fefferman, B. Guillen Pegueroles, C. W. Rowley, M. Weber (2021): Optimal Control with Learning on the fly. *Revista Matemática Iberoamericana*, vol. 37(1).

M. Weber, M. Zaheer, A. Singh Rawat, A. Menon, S. Kumar (2020): Robust large-margin learning in hyperbolic space. *Advances in Neural Information Processing Systems (NeurIPS)*

M. Weber (2020): Neighborhood Growth Determines Geometric Priors for Relational Representation Learning. *International Conference on Artificial Intelligence and Statistics (AISTATS)*

M. Weber, E. Saucan and J. Jost (2018): Coarse Geometry of Evolving Networks. *Journal of Complex Networks*. vol. 6(5), pp. 706-732.

M. Weber, E. Saucan and J. Jost (2017): Characterizing Complex Networks with Forman-Ricci Curvature and Associated Geometric Flows. *Journal of Complex Networks*, vol. 5 (4), 527-550.

### Selected Invited Lectures

2025: Conference on Algebraic Topology: Methods, Computation, and Science (*Keynote*), NetSci Satellite "Network Geometry" (*Keynote*), IEEE Workshop on Graph Signal Processing (*Keynote*), Boston Symmetry Day (*Keynote*), Math4AI/AI4Math Workshop at Max Planck Institute for Mathematics in the Sciences, University of Birmingham

2024: Conference on the Mathematical Theory of Deep Neural Networks (DeepMath) (*Keynote*), Korea Institute for Advanced Study, Tufts, Harvard CMSA Big Data Conference, Harvard-Smithsonian Center for Astrophysics (*Keynote*), NSF AI Institute for Artificial Intelligence and Fundamental Interactions Summer Workshop (*Keynote*), IMSA AI and Pure Math Conference, KTH Stockholm, Zuse Institute Berlin, Imperial College London, AAAI Conference, Banff International Research Station, U of Virginia, U of Cambridge

2023: University of Edinburgh, Mathematics and Machine Learning Conference (*Keynote*), Simons Institute for the Theory of Computing, Northeastern University Network Science Institute, University of Minnesota, ICML Workshop on Topology Algebra and Geometry in Machine Learning (*Keynote*), Sampling Theory and Applications Conference, UC Santa Barbara