

Moritz Nikolaus Laber

complex systems | machine learning | statistical physics

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Education

* denotes expected date

Northeastern University , Boston, United States Network Science, PhD Thesis: <i>Understanding Complex and Learning Systems through Structure, Scale, and Feedback</i> . Advisor: Brennan Klein	Sep. 2022 – Jul. 2027*
Northeastern University , Boston, United States Network Science, Master of Science Advisor: Brennan Klein	Sep. 2022 – Aug. 2024
University of Vienna & CSH Vienna , Vienna, Austria Computational Science, Master of Science Thesis: <i>Systemic Risk in the global food-supply chain network</i> . Advisor: Stefan Thurner	Oct. 2020 – Aug. 2022
Karlsruhe Institute of Technology , Karlsruhe, Germany Physics, Master of Science Thesis: <i>Carbon-Nanotube-Squids — Exploring Superconductor-Quantum-Dot-Junctions</i> . Advisor: Wolfgang Wernsdorfer	Apr. 2018 – Sep. 2020
Karlsruhe Institute of Technology , Karlsruhe, Germany Physics, Bachelor of Science Thesis: <i>Dark-Matter in the N2HDM</i> . Advisor: Margarete M. Mühlleitner	Oct. 2014 – Mar. 2018

Publications & Preprints

* denotes equal contribution

PEER-REVIEWED PUBLICATIONS

- Gupta S., Biggs S., **Laber M.**, Shafi Z., Paul A., Walters R. *DeepWeightFlow: Re-basined Flow Matching for Generating Neural Network Weights* ; The Fourteenth International Conference on Learning Representations (2026).
- Chernikova A., **Laber M.**, Sabhahit N.G., Eliassi-Rad T. *Robustness and Generalization in Uncertainty-Aware Message Passing Neural Networks* ; The 29th International Conference on Artificial Intelligence and Statistics (2026).
- Liu D., Weis E., **Laber M.**, Eliassi-Rad T., Klein B. *Identifying and Upweighting Power-Niche Users to Mitigate Popularity Bias in Recommendations* ; Proceedings of the ACM Web Conference 2026, 6830–6840 (2026).
- Laber M.***, Dies S.* , Ehlert J.* , Klein B., Eliassi-Rad T. *Effects of Higher-Order Interactions and Homophily on Information Access Inequality* ; Communications Physics 9 13 (2026).
- Laber M.**, Klimek P., Bruckner M., Yang L., Thurner S. *Shock Propagation from the Russia–Ukraine Conflict on International Multilayer Food Production Network Determines Global Food Availability* ; Nature Food 4 508–517 (2023).

PREPRINTS & WORK UNDER REVIEW

- Laber M.**, Klein B. *A Guide to Higher-Order Homophily* ; arXiv:2606.02537 (2026). [forthcoming in Social Networks Beyond Pairwise Interactions]
- Laber M.**, Eliassi-Rad T., Klein B. *When Do Neural Ordinary Differential Equations Generalize on Complex Networks* ; arXiv:2602.08980 (2026). [in revision at Nature Communications]
- Sabhahit N.G.* , **Laber M.*** , Hartle H., van der Kolk J., Klein B., Scarpino S.V., Krioukov D. *Deterministic Construction of Typical Networks in Network Models* ; arXiv:2512.02254 (2025). [forthcoming at Nature Communications]

Kumar S., **Laber M.**, Majumder M.S., Foucault Welles B.A., Kiss I.Z. *Multi-strain spreading dynamics under arbitrary transmission kernels* ; arXiv:2502.20460 (2025). [under review at Physical Review E]

Baum S., **Laber M.**, Bruckner M., Yang L., Thurner S., Klimek P. *Adaptive Shock Compensation in the Multi-layer Network of Global Food Production and Trade* ; arXiv:2411.03502 (2024). [under review at Communications Earth and Environment]

WORKING PAPERS

Laber M., Shafi Z., Savcisen G., Klein B., Chinazzi M., Scarpino S.V., Barabási A.L., Vespignani A., Eliassi-Rad T. *Scaling of Capability and Efficiency at Inference Time in Large Reasoning Models* [under review at a non-archival venue]

Laber M., Shafi Z., Savcisen G., Klein B., Chinazzi M., Scarpino S.V., Barabási A.L., Vespignani A., Eliassi-Rad T. *Understanding Chain-of-Thought Reasoning Failures through the Statistical Physics of Language* [manuscript under preparation]

Fairchild-Coppoletti T., **Laber M.**, Klein B., Walters R. *Weight Space Learning without Weights: Leveraging Neural Operators for Model Editing* [manuscript under preparation]

Sabhahit N.G., **Laber M.**, Heeg F., von Pichowski J., Scholtes I., Krioukov D., Eliassi-Rad T. *Quantifying the Effects of Edge Uncertainty on Node Embeddings* [under review at a non-archival venue]

Pieleanu L., **Laber M.**, Sabhahit N.G., Krioukov D. *Percolation in the Stochastic Block Model* [manuscript under preparation]

Sabhahit N.G., **Laber M.**, Hartle H., Pieleanu L., Schepers M., Petri G., Krioukov D. *Erdős-Rényi Random Hypergraphs* [manuscript under preparation]

Weis E., Lizotte S., **Laber M.**, Landry N., Young J.G., Klein B. *Leveraging Arbitrary Competition Structure in Bayesian Inference of Global Rankings*

Weis E., **Laber M.**, Kirkley A., Klein B. *Regionalization via Nonparametric Community Detection in Spatially Embedded Networks*

Laber M., Mohamed M., St-Onge G., Hartle H., Klein B. *Blob Diffusion: Higher-Order Random Walkers on Complex Networks*

Presentations & Non-Archival Posters

* denotes presenter

TALKS

Laber M.*, Klein B. *Mixing Patterns in Higher-Order Networks: A Review* contributed talk at IC²S², Burlington, United States, (2026)

Laber M.*, Klein B. *A Guide to Higher-Order Homophily* contributed talk at NetSci, Boston, United States, (2026)

Laber M.*, Eliassi-Rad T., Klein B. *When do neural ordinary differential equations generalize on complex networks?* contributed talk at NetSI Research Symposium, Boston, United States, (2026)

Laber M.*, *Shock Propagation and Compensation in the Multilayer Network of Global Food Production and Trade* Guest Lecture at UCU Lviv, Lviv, Ukraine, (2025)

Laber M.*, *Robustness & Generalization of Graph Neural ODEs for Network Dynamical Systems* invited talk at Oxford Networks Seminar, Oxford, United Kingdom, (2025)

Laber M.*, Klein B. *Generalization and Robustness of Graph Neural ODEs for Network Dynamical Systems* contributed talk at IAIFI Summer Workshop, Cambridge, United States, (2025)

Laber M.*, Dies S., Ehlert J., Eliassi-Rad T., *On the Effects of Higher-Order Interactions on Information Access Equality* contributed talk at NetSI Research Symposium, Boston, United States, (2025)

Laber M.*, Klein B. *Generalization and Efficiency of Graph Neural ODEs for Network Dynamical Systems* contributed talk at NetSci, Maastricht, Netherlands, (2025)

POSTERS

Laber M.*, Eliassi-Rad T., Klein B. *Robustness and Generalization in Uncertainty-Aware Message-Passing Neural Networks* poster at IAIFI Summer Workshop, Cambridge, United States, (2026)

Chernikova A., **Laber M.***, Sabhahit N.G., Eliassi-Rad T. *Robustness and Generalization in Uncertainty-Aware Message-Passing Neural Networks* poster at IAIFI Summer Workshop, Cambridge, United States, (2026)

Gupta S., Biggs S., **Laber M.***, Shafi Z., Paul A., Walters R. *DeepWeightFlow: Re-Basined Flow Matching for Generating Neural Network Weights* poster at Boston Symmetry Group: Poster Day, Boston, United States, (2026)

Gupta S.*, Biggs S., **Laber M.***, Walters R. Paul A., *Generating Neural Networks from Equivariant Embeddings with Latent Diffusion* poster at Boston Symmetry Day, Boston, United States, (2025)

Laber M.*, Klein B. *Understanding Complex Dynamics with Graph Neural Ordinary Differential Equations* poster at GeMSS, Eindhoven, Netherlands, (2024)

Laber M.*, Klimek P., Bruckner M., Yang L., Thurner S. *Systemic Risk in the Multilayer-Network of Global Production and Trade of Food* contributed talk at NetSci, virtual, (2022)

Awards and Honors

Best Visualization Award IAIFI Summer Workshop 2024, Cambridge, United States	Aug. 2024
CSH Junior Fellow Complexity Science Hub Vienna, Vienna, Austria	since Jan. 2023
Dean's List: Computational Science University of Vienna, Vienna, Austria	Dec. 2022

Service to Profession

NetSci 2026 Outreach Committee NetSci2026, Boston, United States	Jun. 2026
Organizer: Network Geometry Satellite at NetSci 2026, Boston, United States	Jun. 2026
Session Chair: Machine Learning & AI 1 NetSci 2026, Boston, United States	Jun. 2026
NetPlace Executive Board (formerly Society of Young Network Scientists (SYNS))	since Nov. 2024
Organizer SNACS Seminar Network Science Institute, Boston, United States	Sep. 2024 – Dec. 2024
Event Coordinator Network Science GSA Northeastern University, Boston, United States	Feb. 2023 – Sep. 2024
Co-Organizer: Complexity Speaker Series Network Science Institute, Boston, United States	Jan. 2023 – Apr. 2024
Organizer: Paper Unwind Seminar Network Science Institute, Boston, United States	Dec. 2022 – Apr. 2025
Reviewer for over 20 venues Including ACM CSUR, AISTATS, NeurIPS, Nature Communications, and PRX	

Teaching Experience, Course Design, and Mentorship

Mentor Co-op Student &-Lab, Boston, United States	Jul. 2026 – Dec. 2026
Mentor REU Student DK Lab, Boston, United States	Sep. 2024 – Jan. 2025
Post-Secondary Teaching Graduate Certificate Northeastern University CATLR, Boston, United States	Jan. 2024 – Dec. 2025
Teaching Assistant: Network Science 2 Northeastern University, Boston, United States	Jan. 2024 – Apr. 2025
Course Design: Reasoning under Uncertainty with Probabilistic Machine Learning Northeastern University, Boston, United States	Sep. 2023 – Dec. 2023
Course Design: Information Theory & Bayesian Inference for Complex Systems Northeastern University, Boston, United States	Sep. 2022 – Dec. 2022

Tutor: Mathematics Preparatory Course Karlsruhe Institute of Technology, Karlsruhe, Germany	Sep. 2017
Teaching Assistant: Mathematics for Physicists 1 Karlsruhe Institute of Technology, Karlsruhe, Germany	Oct. 2016 – Mar. 2020
Teaching Assistant: Mathematics for Physicists 2 Karlsruhe Institute of Technology, Karlsruhe, Germany	Apr. – Sep. 2016, 2019, 2020
Tutor: Physics for Engineers Preparatory Course Karlsruhe University of Applied Sciences, Karlsruhe, Germany	Sep. 2016, 2018, 2020
Tutor: Physics Preparatory Course Karlsruhe Institute of Technology, Karlsruhe, Germany	Sep. 2016, 2017

Internships

Institute of Science and Technology Austria , Klosterneuburg, Austria Research Intern Supervisor: Johannes Fink	Mar. 2018 – Jun. 2018
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Selected Schools & Workshops

Complex Systems Summer School (CSSS) Santa Fe Institute, Santa Fe, United States	Jul. 2025
IAIFI Summer School & Workshop IAIFI, Cambridge & Boston, United States	Aug. 2024
ELLIS Summer School on Probabilistic Machine Learning University of Cambridge, Cambridge, United Kingdom	Jul. 2024
Generative Modelling Summer School (GeMMS) Eindhoven University, Eindhoven, Netherlands	Jun. 2024
Complex Networks Winter Workshop (CNWW) Québec, Canada	Dec. 2023
CSH Winter School on Green Transition Obergurgl, Austria	Apr. 2022
Erasmus+ Virtual Exchange Debates Karlsruhe Institute of Technology, Karlsruhe, Germany	Feb. 2019
Max Planck Institute for the Science of Light: Autumn Academy Max Planck Institute for the Science of Light, Erlangen, Germany	Oct. 2018
German Physical Society: Theory Workshop on Fractals and Non-Linear Physics Bacharach, Germany	Jan. 2018

Organization Memberships

Association for Computing Machinery (ACM) , Member	since 2026
Network Science Society (NetSci) , Member	since 2022
German Physical Society (DPG) , Member	since 2014

Other Skills

Programming: Python, JAX, PyTorch, Julia, C++, SQL, MATLAB
Languages: German (native), English (proficient), Latin (advanced), French (beginner), Japanese (beginner)