Fabian Glöckle

Curriculum Vitae

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Education

2023 – 2026 **PhD in Machine Learning & Mathematics**, *Institut Polytechnique de Paris & Meta FAIR*, Paris
Supervisors: Amaury Hayat, Gabriel Synnaeve. Co-supervisor: Timothy Gowers (Cambridge).

2018 – 2022 **Master of Science in Mathematics**, *University of Freiburg*, Germany, Grade 1.0
Equivalent to First Class Honours.
Thesis: *Class number phenomena of invariant trace fields* (Grade 1.0).
Presented at *Oberseminar Topologie Universität Wuppertal*.

2015 – 2018 **Bachelor of Science in Mathematics**, *University of Freiburg*, Germany, Grade 1.0

Experience

2023 – 2026 **PhD Researcher**, *Meta FAIR & Institut Polytechnique de Paris*, Paris
Research on language models, reinforcement learning, and formal reasoning systems.
- **Code Llama:** Core contributor to pretraining pipeline (data, infilling objective) for code LLMs up to 70B parameters.
- **Code World Model (CWM):** Contributor to reasoning RL training (math grader, RL code base).
- **Multi-token Prediction:** Novel pretraining loss with industry adoption validated at 7B parameter scale.
- **Distributed RL:** Designed and implemented RL pipelines for neural theorem proving (MCTS, multi-agent RL) and hierarchical code generation.

2023 – 2026 **Master's Student Mentorships:** Jonas Bayer (Syntactic Similarity in human-oriented ATP, M.Sc. thesis); Gwenaëlle Léon (M1 project); Antoine Peyronnet (LemmaBench: A Live, Research-Level Benchmark to Evaluate LLM Capabilities in Mathematics, arXiv preprint).

2024 **Technical Advisor & Mentor**, *Jimini AI (AI Startup Initiative)*
Technical lead for RAG and LLM architecture in a legal professional context.

May – Aug 2022 **Research Scientist Intern**, *Meta FAIR*, Paris
Neural theorem proving group under the supervision of Timothée Lacroix and Guillaume Lample. Automated data synthesis for an MCTS-based neural theorem proving system.

2019 – 2022 **Open Source Contributor**, *Lean Theorem Prover Ecosystem*
Liquid Tensor Experiment: Formalized submodules of free modules over PIDs.
Lean Mathlib: Contributed theory for dual vector spaces.

2017 – 2021 **Teaching Assistant**, *University of Freiburg*, Germany
Assisted in various undergraduate and graduate mathematics courses.

Technical Skills

Languages **Python**, **Lean 4**; **C++** (reading proficiency).

ML & Compute **PyTorch**, Distributed Training (**FSDP**, **TP**), **SLURM** cluster management.
Hardware-aware model design: conceptual understanding of CUDA memory hierarchy and execution to avoid standard performance pitfalls.

Distributed Systems Design and development of custom distributed RL frameworks; proficient in **PyTorch**, **ZMQ**, **Asyncio**, multithreading. Focus on clean architecture and reusable scalable primitives.

Formal Math Interactive Theorem Proving, Dependent Type Theory, **Lean Metaprogramming**.

Languages

Professional German (Native), English (Fluent/C1), French (Fluent/C1).

Awards & Honors

2025 **Top Reviewer** at NeurIPS 2025.

2022 **Excellent Master Thesis Prize**
Awarded by the University of Freiburg alumni society.

2015 – 2022 **German Academic Scholarship Foundation** (*Studienstiftung des deutschen Volkes*)
Scholarship awarded to the top 0.5% of students nationally. Included a dedicated Student Exchange Grant in 2019.

2014 **Best Abitur in Baden-Württemberg**
Ranked 1st in the state for the German university entrance examinations (Grade 1.0).

Selected Publications

2026 F. Gloeckle, A. Rammal, C. Arnal, R. Munos, V. Cabannes, G. Synnaeve, A. Hayat: Automatic Textbook Formalization. arXiv:2604.03071, 2026.

2026 F. Gloeckle, M. Bakšys, D. Feher, K. Zheng, A. Hayat, S. B. Holden, G. Synnaeve, P. O'Hearn: WybeCoder: Verified Imperative Code Generation. Under review at ICML 2026. arXiv:2603.29088, 2026.

2026 F. Gloeckle*, J. Decugis*, F. Bach, T. Cohen, G. Synnaeve: RL for Hierarchical Code Generation and Inference-Time Scaling. Under review at TMLR 2026 (* joint first).

2025 F. Gloeckle, A. Gu, G. Synnaeve, A. Hayat: Reinforcement Learning for Hierarchical Proof Generation in Lean 4. NeurIPS MATH-AI 2025.

2025 A. Gu, B. Piotrowski, F. Gloeckle, K. Yang, A. H. Markosyan: ProofOptimizer: Training Language Models to Simplify Proofs without Human Demonstrations. ICLR 2026.

2025 FAIR CodeGen team: CWM: An Open-Weights LLM for Research on Code Generation with World Models. arXiv:2510.02387, 2025.

2024 F. Gloeckle, J. Limperg, G. Synnaeve, A. Hayat: ABEL: Sample Efficient Online Reinforcement Learning for Neural Theorem Proving. NeurIPS MATH-AI 2024.

2024 F. Gloeckle*, B. Y. Idrissi*, B. Rozière, D. Lopez-Paz, G. Synnaeve: Better & Faster Large Language Models via Multi-token Prediction. ICML 2024 (* joint first).

2023 B. Rozière*, J. Gehring*, F. Gloeckle*, S. Sootla*, G. Synnaeve* et al. Code Llama: Open Foundation Models for Code. arXiv:2308.12950, 2023 **(* core contributor)**.

2023 F. Gloeckle, B. Rozière, A. Hayat, G. Synnaeve: Temperature-scaled Large Language Models for Lean Proofstep Prediction. NeurIPS MATH-AI 2023.

Invited Talks

Dec 2025 AI Morning for Mathematics: Proof Assistants and LLMs, LJLL, Sorbonne Université, Paris.

Oct 2025 La philosophie de la pratique des mathématiques, Séminaire at Collège de France, Paris.

Sept 2025 Machine Learning and AI for Mathematics, Mathematisches Forschungszentrum Oberwolfach.

Sept 2025 Mechanization and Mathematical Research, Lorentz Center Leiden.

July 2025 Machine Learning and Mathematics, Korea Institute for advanced Study.

May 2025 Mathematics for and by Large Language Models, Institut des Hautes Études Scientifiques.

Apr 2025 DL Models for Mathematics and Type Theory, Chalmers AI Research Centre (CHAIR).

July 2024 Sacl-AI 4 Science Workshop, Paris.

Leadership & Extracurriculars

2015 – 2022 **University Debating**, *Debating Society Freiburg*
Semi-finalist in regional competitions, competed in national finals. Served as Treasurer (2017–2018) and organized a national tournament.

2015 – 2021 **Student Government**, *University of Freiburg*
Elected member of the Mathematical Institute's study and faculty boards; active member of the Student Association.