Maurice D. Hanisch

Google Scholar: MD Hanisch
LinkedIn: MauriceHanisch
Email: mhanisch@caltech.edu
Mobile: (626) 394-7713

Education

California Institute of Technology, *Ph.D. Math & CS* 09/2025 – Present
Pasadena, USA
- Pursuing research in ML for quantum chemistry and materials science, advised by Prof. Anima Anandkumar.
- Fully funded through the Kortschak Fellowship, awarded based on academic excellence and research potential.

ETH Zurich, *M.Sc. Physics* **5.77/6.00 (Top 12%)** 09/2022 – 05/2024
Zurich, Switzerland
- Expanded analytical skills with a focus on quantum theory and information technologies, with 30% excess credits in mathematics, ML and probabilistic AI involving 8 team projects, all graded 6.00/6.00 (*projects*).

LMU Munich, *B.Sc. Physics* **1.28/1.00 (Top 10%)** 10/2018 – 09/2022
Munich, Germany
- Acquired extensive grounding in key physics fields, providing a strong foundation in the principles driving modern technologies, and fostering advanced analytical and problem-solving skills.

Work Experience

Bloomberg CTO Office, *Security Research Intern, Julien Vanegue's Team* 06/2025 – 09/2025
New York, USA
- Stress-tested the CHERI CPU architecture, a $300 million industry-academic security effort, by attempting to break its memory-safety guarantees to determine its suitability for Bloomberg's infrastructure.
- Discovered multiple attack vectors that compromise both spatial and temporal memory safety guarantees.
- Contributed mitigations to the open-source CHERI software via multiple PRs (*jemalloc*, *dlmalloc*, *c-guide*).

California Institute of Technology, *ML Research Intern, Anima Anandkumar's Group* 09/2024 – 05/2025
Pasadena, USA
- Led a large-scale benchmark, retraining seven SOTA molecular models for open-shell and charged systems, validating our proposed method, *OrbitAll*, in our published work.
- Developed a differentiable quantum feature generation pipeline for GNN-based models, enabling end-to-end differentiability of physics-informed learning of quantum chemical properties.
- Submitted PRs to chemistry ML tooling: PyTorch (*optimized eigensolver selection*) and tblite (*lightweight SCF restarts*).

Research Experience

IBM, *Master's Thesis, Stefan Woerner's Group* | *Thesis (PDF)*, *Project repository* **6.00/6.00** 09/2023 – 05/2024
Zurich, Switzerland
- Conducted state-of-the-art research on error correction at a global leader in the quantum computing industry.
- Developed a Python/C++ decoding pipeline that scaled to billions of measurement records per run, enabling one of IBM's then-largest error-correction experiments.
- Designed and deployed the full experimental pipeline on IBM Q hardware, showing that analog-information decoding can improve logical error rates by up to 30x in large-scale repetition-code experiments.

ETH Zurich, *Summer Project, Jonathan Home's Group* | *Thesis (PDF)* 06/2023 – 08/2023
Zurich, Switzerland
- Investigated the motional interaction of ions trapped in an electromagnetic field for use in quantum computing.
- Designed and simulated trapping potentials using Python to enable a beamsplitter interaction.
- Experimentally validated the designed potentials on GKP-encoded qubits within a trapped-ion setup.

MPI for Quantum Optics, *Bachelor's Thesis, Ignacio Cirac's Group* | *Thesis (PDF)* **1.30/1.00** 04/2022 – 09/2022
Garching, Germany
- Investigated efficient algorithm design and resource optimization for Gaussian quantum circuits.
- Applied complexity theory and mathematical techniques to prove that bosonic Gaussian circuits can be implemented on quantum computers with exponentially fewer qubits compared to a direct encoding.

Selected Publications

MGB: The Material Generation Benchmark
- L. Yan, B.S. Kang, M.D. Hanisch, J. Ma, A. Anandkumar - NeurIPS AI4Mat Workshop (2025)

OrbitAll: A Unified Quantum Mechanical Representation Deep Learning Framework for All Molecular Systems
- B.S. Kang, V.C. Bhethanabotla, M.D. Hanisch, W.A. Goddard III, A. Anandkumar - arXiv:2507.03853 (2025)

Soft information decoding with superconducting qubits
- M.D. Hanisch, B. Hetényi, J.R. Wootton - arXiv:2411.16228 (2024)

Extracurricular Activities and Competitions

- Participated in 10+ technical competitions and workshops across cities like Paris, Munich, Zurich and New York, sponsored by companies ranging from consulting firms (Bain, McKinsey) to tech giants (Bloomberg, Infineon, NVIDIA, EDF).
- Frequently selected through competitive application processes, often with expenses (travel, accommodation, meals) covered.
- Won over $3500 in hackathon prizes for projects using recurrent NNs, time series, LLMs, CUDA-Q, SageMaker and Hugging Face.

Hackathons: **1st/30** at ETH QHack 2024: *NVIDIA task* | **1st/12** at LOQC 2023: *EDF task* | **2nd/6** at ETH QHack 2023: *IQM task*

Technical Skills and Interests

Programming: Python, C, C++, Fortran, Matlab, SQL | PyTorch, TensorFlow, Scikit-learn | Git, Linux, Latex, Docker
Languages: German (native), French (native), English (C1: IELTS 8/9), Italian (A1)
Interests: Weightlifting, Volleyball, Calisthenics, Surfing, Chess