

Luis Wirth

MSc Student in Computational Science and Engineering at ETH Zürich

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Education

2025 – (2027)

MSc ETH Computational Science and Engineering

ETH Zürich – Zürich, CH

- **GPA:** 5.64/6.0
- **Field of specialization:** Computational Electromagnetics
- **Focus:** Physics-Informed Machine Learning
- **Semester Project:** BEM Benchmark of the Ehrenpreis–Palamodov Gaussian Process for Maxwell Cavity Scattering
- **Key Coursework:**
 - Computational and Statistical Aspects of Diffusion Models* (Stochastic Calculus, Time-Reversal, Score/Flow Matching)
 - AI in the Sciences and Engineering (PINNs, Graph Neural Operators, Physics Foundation Models)
 - CSCS Summer School* (HPC, CUDA, MPI)
 - Advanced Numerical Methods for CSE (Boundary Element Method, Hybrid Modeling for PDEs, GPs)
 - Electromagnetics and Differential Forms* (Differentiable Manifolds, De Rham Complex, DF Discretization)
 - Semiconductor Devices: Quantum Transport at the Nanoscale* (Transistor-Level Simulation, NEGF)
 - Neuromorphic Engineering I (CMOS Device Physics, Subthreshold CMOS, Analog VLSI)
 - VLSI 1: HDL Based Design for FPGAs (RTL, SystemVerilog, Xilinx Vivado)
 - VLSI 2: From Netlist to Complete System on Chip* (Full-Custom HFT ASIC Project)
 - VLSI 3: Full-Custom Digital Circuit Design (Transistor-Level CMOS, Standard-Cell Design, Cadence Virtuoso)

* currently enrolled

2021 – 2025

BSc ETH Computational Science and Engineering

ETH Zürich – Zürich, CH

- **GPA:** 5.41/6.0
- **Field of specialization:** Computational Physics
- **Focus:** Finite Element Exterior Calculus
- **Thesis:** Rust Implementation of Finite Element Exterior Calculus on Coordinate-Free Simplicial Complexes
- **Key Coursework:**
 - Numerical Methods for Partial Differential Equations (Finite Element Method, Conservation Laws)
 - Numerical Solution of Stochastic Ordinary Differential Equations (Itô calculus, Euler–Maruyama)
 - Computational Quantum Physics (Multi-Body Problems, Tensor Network States)
 - Statistical Physics and Computer Simulation (Molecular Dynamics, Thermodynamics)
 - High-Performance Computing (Distributed Computing, MPI, OpenMP)
 - Systems Programming and Computer Architecture (C, x86-64 Assembly, Virtual Memory, Caching)
 - Information Theory (Shannon Entropy, Mutual Information, Coding, Typical Sequences)

Professional Experience

2024

February –
June

Teaching Assistant NumPDE

ETH Zürich (Seminar for Applied Mathematics) – Zürich, CH

- TA for “Numerical Methods for Partial Differential Equations” (Prof. R. Hiptmair)
- Instructed students in weekly tutorials on mathematical theory and C++ implementation

2020

June –
December

R&D Software Engineer

University of Basel (Dept. of Biomedical Engineering) – Basel, CH

- Joined the MIRACLE project (Minimally Invasive Robot-Assisted Computer-guided Laserosteotome)
- Developed SpectoVR, a virtual reality surgical planning tool
- Implemented real-time multi-volume raymarching with distance-field empty-space skipping for CT/MRI scans
- Added PET-CT scan visualization support

2019

July – August

Software Engineer Intern

Adobe – San Francisco, USA

- Joined the Adobe Experience Manager Screens team
- Built a content targeting prototype using TensorFlow for personalized digital signage delivery

2018

July

Computational Physicist Intern

University of Basel (Dept. of Physics) – Basel, CH

- Implemented a custom neural network with backpropagation in C++/Eigen
- Trained the model to predict the potential energies of the water molecule from atomic configurations

Technical Projects & Open-Source

Formoniq | Rust, FEEC, Differential Geometry, WebGPU

Coordinate-free finite element exterior calculus engine for PDEs on pseudo-Riemannian manifolds of arbitrary dimension

- Structure-preserving engine for Hodge-Laplace and Hodge-Dirac operator
- Arbitrary dimension and form degree and support for non-trivial topology
- Regge calculus for any metric signature: Riemannian and Lorentzian (spacetime)
- Discretization of de Rham complex (nilpotency, cohomology, and Hodge decomposition)
- ~12k lines of pure Rust across 8 modular crates, each a self-contained mathematical library
- Parallelized solver toolchain in Rust (faer direct solves, rayon-parallel assembly)
- Interactive WebGPU/WebAssembly viewer: formoniq-studio.lwirth.com
- Repository: [GitHub](#)

Carveout | Rust, Rendering, WebGPU, WebAssembly

High-Performance Digital Pen Note-Taking Application

- Nonlinear undo-tree data structure to preserve full editing history across branches
- Rendering with WebGPU for cross-platform hardware acceleration
- WebAssembly app with custom egui-winit-wgpu integration
- Repository: [GitHub](#)

Arcus | Rust, Embedded Programming, RTIC, Microcontroller

Smart LED Strip with Interactive Animations

- Embedded Rust based on real-time interrupt-driven concurrency (RTIC)
- Raspberry Pi Pico RP2040 microcontroller
- Programmable IO state machine driver for WS2812 LEDs using PIO assembly
- Controller support for UART, bluetooth and infrared remote
- Repository: [GitHub](#)

Publications & Talks

Semester Project: BEM Benchmark of the Ehrenpreis–Palamodov Gaussian Process for Maxwell Cavity Scattering

ETH Zürich – July 2026

- Supervisor: Prof. Dr.-Ing. Stefan Kurz
- Topics: Maxwell's Equations, Boundary Element Method, AI4science, Gaussian Processes, Exterior Calculus

BSc Thesis: Rust Implementation of Finite Element Exterior Calculus on Coordinate-Free Simplicial Complexes

ETH Zürich – May 2025

- “The best BSc thesis I have seen in years” — Prof. R. Hiptmair
- Topics: PDEs, FEM, Differential Geometry, Exterior Calculus, de Rham Cohomology, Regge Calculus
- Paper: [arXiv:2506.02429](https://arxiv.org/abs/2506.02429)
- Presentation: [YouTube](#)

Seminar Talk: Lean 4 and the Curry-Howard Isomorphism

ETH Zürich (ZUCCMAP) – November 2024

- Topics: Functional Programming, Type Theory, Propositions-as-Types and Formal Verification
- Recording: [YouTube](#)

Skills

Technical:

- Languages: C++, Rust, Python, Lean4, Julia, SystemVerilog
- HPC: MPI, OpenMP, PETSc
- ML Frameworks: PyTorch, JAX
- Graphics / GPU: Vulkan, WebGPU, Compute Shaders
- EDA / Hardware: Cadence Virtuoso, Xilinx Vivado
- Tooling: Linux, Nix, Git, Typst, LaTeX

Spoken Languages: German (native), English (C2), French (B1), Spanish (A2)