

Daniele Cucurachi

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Summary

Computational physicist with experience in scientific software development and research. Currently, I am working on a research project focused on quantum algorithms in collaboration with the *Quantum Information Group* (University of Cambridge). **References available upon request.**

Education

University of Cambridge

Visiting Student (Master's Thesis)

Cambridge, UK

Sep 2022 - Mar 2023

- Winner of the **Scientifica VC "Thesis" Award**

EPFL - École Polytechnique Fédérale de Lausanne

Master of Science in Applied Physics

Lausanne, Switzerland

Sep 2020 - Jun 2023

- Final GPA: **5.63/6.00** (top 10% in the class of 2023)
- EPFL is ranked **11th worldwide** in the 2023 QS World University Rankings for "Engineering & Technology"
- Relevant coursework: Machine Learning, Deep Learning, Quantum Information, Quantum Computing, Quantum Optics

Politecnico di Torino

Bachelor of Science in Physics Engineering

Torino, Italy

Sep 2017 - Jul 2020

- Final Grade: **110/110 with honors** (top 5% in the class of 2020)

Professional Experience

Research Assistant

Cambridge, UK and remote

Quantum Information Group (University of Cambridge)

Jun 2023 - Present

- Developed a subroutine for optimizing parametrized proposal strategies in quantum-enhanced Monte Carlo Markov chains. A Python simulator of the first version of the algorithm is available at <https://github.com/DanieleCucurachi/QMCMC.git> (based on the packages NumPy, SciPy, Pandas).
- Working on improving the simulator through GPU-accelerated computing (PyTorch) to perform faster large matrix operations and distributed computing (Python module Ray) to reduce the simulation time (private code).
- Currently in the process of finalizing and preparing this project for submission to a peer-reviewed journal.

Quantum Software Engineer (Internship)

Helsinki, Finland

IQM Quantum Computers

Feb 2022 - Aug 2022

- Developed Python libraries for the design and simulation of superconducting quantum processors:
 - Submitted approximately 25 merge/pull requests within my first six months. A small part of my contributions can be found at <https://github.com/iqm-finland/KQCircuits/commits?author=danielecucurachi@iqm> (open source projects only).
 - Conducted code reviews for projects involving up to 15 contributors, ensuring code quality (hands-on experience with GitLab continuous-integration pipelines).
 - Collaborated closely with the *IQM Fabrication Team* to design photomasks' layouts and various components of quantum processors.
 - Developed a software tool to exponentially speed up the routing of quantum processors, currently utilized by the *IQM Design Team*.
- Simulated the electromagnetic performance of superconducting quantum processors through finite element methods (ANSYS HFSS).

Research Projects

Apodization of coupled cavity array for waveguide QED (Quantum Electrodynamics)

Lausanne, Switzerland

Hybrid Quantum Circuits Lab (EPFL)

Sep 2021 - Jan 2022

Designed coupled resonator waveguides tailored for slow light applications in superconducting circuits. The project involved finite element method simulations (ANSYS HFSS and Sonnet) and the development of a Python library (based on the Python module gdspy) to optimize and speed up the design workflow. For more details, please visit my website at <https://danielecucurachi.github.io/personal-website/project/slowlight/>.

Localized crystallization of Germanium nanowires for hole spin qubits fabrication

Lausanne, Switzerland

Laboratory of Semiconductor Materials (EPFL)

Sep 2020 - Jan 2021

Conducted data analysis on Raman spectroscopy experiments (hands-on experience with optical setups) to characterize Ge nanowires, aiming to optimize the crystallization process and enhance the crystal quality. My work enabled the utilization of the nanowires to produce fully functioning hole spin qubits. For more details, please visit my website at https://danielecucurachi.github.io/personal-website/project/ge_nanowires/.

Technical Skills & Languages

Programming Languages

Python, C++ (basic), MATLAB

Python Packages

PyTorch, Scikit-Learn, Numpy, Pandas, Scipy, KQCircuits, Gdspy, Ray, Matplotlib, Qiskit, QuTip

Software & Tools

GitLab and GitHub with Git for collaborative software development, ANSYS High Frequency Simulation Software (HFSS), KLayout (GDS files editing), Sonnet Software, LTspice (analog circuit simulations), \LaTeX (technical writing)

Experience with

GitLab CI/CD, Numerical Simulations, Data Analysis and Visualization | **OS:** Windows, Linux (Ubuntu)

Languages

Italian (Native), **English** (Full Professional Proficiency, level C2), **French** (Elementary Proficiency, level B1)

Associations

Vice President

Lausanne, Switzerland

EPFL Quantum Computing Association

Feb 2021 - Sep 2022

- As team leader for a group of five, organized three successful association events and managed advertising campaigns to promote them.
- Last organized event "EPFL Quantum Hackathon" (<https://memento.epfl.ch/event/epfl-quantum-hackathon-2/>): approximately 100 international participants, the event was focused on quantum chemistry simulations. Secured funding from the company *Quantum Machines*.