Andrea MAIANI
Postdoctoral researcher | Quantum Engineer

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♦ 1307, København (Denmark)

I specialize in the development of next-generation platforms for quantum information processing, utilizing a full-stack chip-to-algorithm approach. With a focus on quantum device modeling, my expertise lies in hybrid superconducting devices and superconducting qubits. I am passionate about advancing the field by researching and implementing computational methods for designing and scaling quantum processors, as well as exploring quantum error correction and quantum control.

▤ COMPETENCES

Programming languages	Python, C++, CUDA, Mathematica
Material modeling	Finite elements analysis, Semiconductors, Superconductors, Magnetic materials, Hybrid heterostructures
Quantum computing	Qiskit developer certificate, cQED, Quantum information theory, Superconducting qubits
Statistical analysis	Statistical inference, Generalized linear model, Time series analysis, Nonlinear regressions
Future research interests	Quantum error correction, Quantum computing applications, Tensor networks

💼 PROFESSIONAL EXPERIENCE

Current
August 2023 — Postdoctoral associate, CENTER FOR QUANTUM INFORMATION PHYSICS — New York University
> ❯ Help translate theoretical models to experimental designs.

`Quantum nanoelectronics` `Superconducting qubits` `Topological superconductivity`

July 2023
November 2019 — Research fellow, CENTER FOR QUANTUM DEVICES — Copenhagen University
> ❯ Ferromagnetic-superconductor-semiconductor devices: proximity effects theory, application to synthetic topological superconductivity, and to unconventional Josephson junctions.
> ❯ Development of parity-protected superconducting qubits.
> ❯ Electrostatic simulations of hybrid devices (collaboration with Microsoft Q).
> ❯ Development of nonlocal tunneling spectroscopy theory.
> ❯ Close collaboration with experimental groups.
> ❯ T.A. in Advanced Quantum Mechanics, Condensed Matter Physics II, Quantum Nanoelectronics.
> ❯ Supervision of one Master's student thesis work

`Quantum nanoelectronics` `Superconducting qubits` `Topological superconductivity`

November 2019
January 2019 — Research intern, KTH INSTITUTE OF TECHNOLOGY — Stockholm
> ❯ I designed a method to study vortex nucleation problems in superconductors and coded a highly efficient GPU implementation.

`Superconducting vortices` `Computational Physics` `CUDA C++`

🖥 SELECTED PROJECTS

PYUSADEL   JUNE 2022 - ACTIVE
🔗 Github repository
Finite difference solver of the self-consistent Usadel nonlinear PDEs for modeling superconductor-ferromagnet heterostructures.

`Computational Physics` `Python` `Superconductivity`

MEPGL   JANUARY 2019 - ACTIVE
🔗 Github repository
Numerical implementation of the gauged string method for the determination of minimum free energy paths in Ginzburg-Landau theories for superconductors and superfluids. Started as a master's thesis project, it is still under active development and has been used in several papers.

`Computational Physics` `CUDA C++` `Superconductivity`

FBS-PV   JUNE 2018 - JUNE 2019
🔗 Project website
Alta Scuola Politecnica final multidisciplinary project. Development of a Fly-by-Sensors drone for automatic identification of defects and anomalies of photovoltaic panels in extended solar power plants.

`Drones` `Image recognition` `Automatic maintenance`

🎓 Education

April 2023 **November 2019**	**Ph.D. in Theoretical Physics, Copenhagen university** › Courses: Condensed Matter Theory 1 & 2, Quantum information theory. › Thesis: *Modeling of Hybrid Nanoelectronic Devices for Quantum Information Processing.*	Copenhagen

October 2019
September 2017
	Master of Science in Engineering Physics, Politecnico di Milano
	› Member of the Italian national team at **International Physicsts' Tournament** (Moscow, 2018).
	› Student at **Alta Scuola Politecnica**.
	  Joint program with Politecnico di Torino for selected students which follows an additional curriculum
	  focused on innovation and entrepreneurship.
	› Second Master's degree in *Physics of Complex Systems* from Politecnico di Torino.
	› Final grade: 110/110 with honors.
		Milan

August 2018 **August 2019**	**Erasmus+ Exchange year, KTH Institute of Technology** › Thesis: *Minimum Free Energy Paths of vortices nucleation in superconductors.*	Stockholm
September 2017 **September 2014**	**Bachelor of Science in Engineering Physics, Politecnico di Milano** › Merit scholarship for the most outstanding freshmen (2015) › Thesis: *Supersymmetric and Kramers-Kronig reflectionless potentials for matter and optical waves.* › Final grade 110/110 with honors.	Milan
July 2018 **September 2014**	**Resident student, Collegio di Milano** › Interdisciplinary college of excellence for 100 selected students from Milan universities certified by the Italian Ministry for Education. › Merit scholarship for college students by INPS.	Milan
June 2014 **September 2009**	**Scientific High School Diploma, Liceo Scientifico Nicolò Copernico** › Upgraded scientific track. › Final Grade: 100/100. › Merit scholarship for most outstanding students by BPER Bank.	Bologna

📖 Selected publications

[1] Andrea Maiani, Morten Kjaergaard, and Constantin Schrade. "Entangling Transmons with Low-Frequency Protected Superconducting Qubits". In: *PRX Quantum* 3.3 (Aug. 2022), p. 030329. DOI: 10.1103/prxquantum.3.030329.

[2] Andrea Maiani, Max Geier, and Karsten Flensberg. "Conductance matrix symmetries of multiterminal semiconductor-superconductor devices". In: *Physical Review B* 106.10 (Sept. 2022), p. 104516. DOI: 10.1103/physrevb.106.104516.

[3] A. Maiani, R. Seoane Souto, M. Leijnse, and K. Flensberg. "Topological superconductivity in semiconductor–superconductor–magnetic-insulator heterostructures". In: *Physical Review B* 103.10 (Mar. 2021), p. 104508. DOI: 10.1103/physrevb.103.104508.

[4] Samuel D. Escribano, Andrea Maiani, Martin Leijnse, Karsten Flensberg, Yuval Oreg, Alfredo Levy Yeyati, Elsa Prada, and Rubén Seoane Souto. "Semiconductor-ferromagnet-superconductor planar heterostructures for 1D topological superconductivity". In: *npj Quantum Materials* 7.81 (Aug. 2022). DOI: 10.1038/s41535-022-00489-9.

[5] Andrea Benfenati, Andrea Maiani, Filipp N. Rybakov, and Egor Babaev. "Vortex nucleation barrier in superconductors beyond the Bean-Livingston approximation: A numerical approach for the sphaleron problem in a gauge theory". In: *Physical Review B* 101.22 (June 2020), p. 220505. DOI: 10.1103/physrevb.101.220505.