Francesco Pio **Barone**

University of Padova | PhD student in Quantum Physics

Random walker between road biking, Linux software, and quantum physics.

Date of birth: 22 July 1999 **Nationality**: Italian
Now in Padova, Italy
Area of interest: quantum information | quantum error correction | tensor networks

An updated version of this CV is always available at baronefr.github.io/cv/.

@ francescopio.barone@phd.unipd.it baronefr Scholar baronefr.github.io

Education

PhD student in Quantum Physics University of Padova (IT) · 2024 - 2027

I work in the Quantum Information and Matter group, supervised by Prof. Simone Montangero.

- I focus on **quantum error correction**, quantum information and large-scale **quantum simulations** with optimized numerical methods.
- In collaboration with European projects PASQuanS2 and EuRyQa.

MSc in Physics of Data University of Padova (IT) · 2021 - 2024

This MSc curriculum is focused on **computational physics** and **quantum computing**.

- **Final grade**: 110/110 cum laude. **GPA**: 29.8/30.
- **Internship** @CERN Quantum Technology Initiative. **Erasmus** semester @Universität Innsbruck.
- Resident of University Merit College "Don Nicola Mazza".
- **Thesis** @Universität Innsbruck: "Floquet counterdiabatic protocols for Quantum Annealing on Parity architecture".

BSc in Physics University of Catania (IT) · 2018 - 2021

- **Final grade**: 110/110 cum laude.
- **Thesis** on computational astrophysics: "A new framework for real time gravitational wave detection".

Research experience

Universität Innsbruck, Institute of Theoretical Physics // Visiting student Innsbruck (AT) · Sept. 2023 - Feb. 2024

Master thesis project in the Quantum Optimization group. Supervised by Prof. Wolfgang Lechner, I have worked on quantum annealing optimization on the Parity architecture.

CERN Quantum Technology Initiative // Full-time Quantum Computing Intern Genève (CH) · June - Sept. 2023

CERN openlab program: I have worked on simulation and optimization of quantum annealing protocols, applying quantum optimal control and counterdiabatic driving to the preparation of spin systems in non-trivial phases.

Publications

2024 F.P. Barone - **Floquet counterdiabatic protocols for Quantum Annealing on Parity architecture** (thesis.unipd.it)

2024 F.P. Barone et al. - **Counterdiabatic optimized driving in quantum phase sensitive models** (DOI:10.1088/1367-2630/ad313e)

2023 F.P. Barone et al. - **A Novel Multi-Layer Modular Approach for Real-Time Fuzzy-Identification of Gravitational-Wave Signals** (DOI:10.1088/2632-2153/ad1200)

2018 (collaboration) **How does cosmic ray flux vary with altitude? Let's ask it to EEE project students** (DOI:10.1393/gdf/i2018-10306-2)

Partecipations, achievements and honors

2024 **Conference** partecipation: **Cineca Quantum computing** and **European Tensor Network school**. University of Padova

2023 **Conference** partecipation: **INQA** (International Network on Quantum Annealing). University of Innsbruck

2023 **Poster** at the **Quantum Error Correction & Mitigation Workshop** (16-18 October). University of Trento

2022 **PennyLane Code Camp 2023.** My team earned 7th place out of 500+ participants.

2019 **Merit scholarship** (2019-2021) for being among the top 5 students in my degree course. University of Catania

2018 **Olifis Italy finalist.** Finalist of the national Olympiad of Physics. Senigallia (IT)

2018 **Certamen Nazionale Fisico-Matematico** "Fabiana D'Arpa": 3rd place. Maglie (IT)

Extracurricular activities

Lecturer of Linux course — Padova (IT) · April 2024

Lecturer of an introductory course about **Linux OS** for the university students of Collegio di merito Don Nicola Mazza.

Senior Tutor for Physics — Scuola Superiore di Catania (IT) · Aug. - Sept. 2019

Tutor for Physics students at the European Olympiad of Experimental Science (eoes.it) summer school, in charge of supervising analysis of didactic laboratory data and lecturing on 4th- and 5th-year high-school topics.

Extreme Energy Events project — Erice (IT) · 2017-2018

Student member of EEE project, a research activity by Centro Fermi & INFN which involves students actively using and analyzing data of MRPC particle detectors.

Skills

Computer stuff

Actively coding in	C, C++, Python, Julia
In love with	Bash scripting, LaTeX
Experience with	Fortran, CUDA, ROOT, R, Matlab, Visual Basic
Hardware	Arduino, Raspberry Pi, FPGA (VHDL design)
Operative systems	Fedora, Debian, Kali, Windows (if requested)
Quantum SDK	broad experience with Qiskit, PennyLane, Qibo, and QuTiP
etc	machine learning libraries, distributed computing, databases

Language

	Understanding	Speaking	Writing
Italian	Native	Native	Native
English	C1	C1	C1
French	A1	A1	A1

Others

Volunteering	volunteer for Italian Red Cross (2018-2022)

Portfolio

Most of my projects are published in GitHub. In the following, I list only those related to my academic activities. Look at GitHub/my website for general-purpose libraries, utilities, LaTeX templates, and lecture notes.

Counterdiabatic Optimized Local Driving annealER — CERN-IT-INNOVATION/colder · 2023
Optimization of Quantum Annealing schedules with hybrid counterdiabatic driving and quantum optimal control methods.

Digitized Quantum Annealing via Tensor Network simulations — perceptron-dqa · 2023
Quantum Annealing simulation via Tensor Networks for a binary perceptron Hamiltonian.

Neural Style Transfer — neural-style-transfer · 2023
Deep CNN-based method to perform Image2Image arbitrary style transfer given two input pictures.

HAVOK and Reservoir computing for chaotic dynamics forecast — rhavok-analysis · 2022
Forecasting and controlling chaotic behavior through the HAVOK technique (by S. Brunton et al) and modern developments in Reservoir Computing. Eventually, a simple Reinforcement Learning demo model is used to control a Lorenz system.

Streaming processing of cosmic rays — streaming-cosmic-rays · 2022
Live analysis of events detected by cosmic rays telescopes in Legnaro INFN laboratories. The data is analyzed in a distributed fashion through Apache Spark, producing a live data quality dashboard.

Mean-timer technique in drift tubes detectors — mean-timer-technique-... · 2022
An implementation of the mean-timer technique in drift tube detectors.

Reprogrammable FIR filter on FPGA — mapd_7taps_fir · 2021
VHDL design of FPGA FIR filter, whose coefficients can be re-configured runtime using the UART interface.