Stefano **Mangini**

PhD Student · Theoretical Physics

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Introduction

I am a PhD student in Theoretical Physics in the Quantum Information Theory (QUIT) group at the University of Pavia, under the supervision of Prof. Chiara Macchiavello. I am interested in the study of Quantum Technologies, and I wish to play an active role in their development. At the moment, my research is focused on Quantum Computation and Quantum Machine Learning for NISQ devices.

Interests: Quantum Computing, Quantum Machine Learning, Artificial Intelligence, Computation

Anagraphics

Nationality	Italian
Personal Address	Via Roma 25A, Putignano, 70017, Italy
Birth date	20 January 1996
Personal Email	mangini.stfn@gmail.com

Education

Cambridge Quantum (Quantinuum)

London, United Kingdom

Quantum Machine Learning Intern — *Apr. 2022 - Aug. 2022*

- Research Internship position in the Quantum Machine Learning team at Cambridge Quantum (Quantinuum).

University of Pavia

Pavia, Italy

PhD in Theoretical Physics — *Nov. 2019 - Ongoing*

- Currently researching on Quantum Computation and Quantum Machine Learning. *Supervisor: Prof. Chiara Macchiavello*

University of Trieste

Trieste, Italy

MSc in Theoretical Physics — *Oct. 2017 - Oct. 2019*

- Final Grade: 110/110 cum laude.
- Thesis: Continuous Quantum Neuron. *Supervisors: Prof. Fabio Benatti, Prof. Stefano Mancini*
  Study of a possible model for a Continuous Optical Quantum Neuron. In particular, starting from an optical circuit capable of implementing the dynamics of a Perceptron, various encoding for classical data into quantum states are studied. Ideal and real case with states comprising an energy bound are taken into account. Examples of entangled and superposition states were also considered.

University of Trieste

Trieste, Italy

BSc in Physics — *Oct. 2014 - Jul. 2017*

- Final Grade: 110/110 cum laude.
- Thesis: The Ehrenfest model and the dynamics of neutral mutations in evolutionary genetics. *Supervisor: Prof. Edoardo Milotti*
  Study of the statistical mechanical model first introduced by Ehrenfest, applied to the description of the dynamics of a neutral mutation in a simulation of a group of cells. The research involved both theoretical aspects concerning the study of the statistical and biophysical model, and computational ones related to the programming of the simulation written in C++.

High School "Majorana-Laterza"

Putignano, Italy

Scientific High School — *Sep. 2009 - Jul. 2014*

- Final Grade: 100/100.

Skills

Quantum Programming	Qiskit, PennyLane, Tensorflow Quantum, PyQuil
ML Programming	Jax, Tensorflow & Keras, PyTorch
Programming	Python, Fortran, Bash, C/C++
Scientific Software	LaTeX, Mathematica
Soft skills	Communicative, Cooperative, Receptive, Versatile, Creative, Autonomous
Language	Italian (*mother tongue*), English (*very fluent*)
Video Editing	Final Cut Pro, Manim (Basics, for mathematical animations)

Publications

Up-to-date list of publications on *Google Scholar* *arXiv*

2022 **Entanglement entropy production in Quantum Neural Networks** Ballarin M., Mangini S., Montangero S., Macchiavello C. and Mengoni R., *arXiv preprint arXiv:2206.02474.*

2022 **Quantum variational learning for entanglement witnessing** Scala F., Mangini S., Macchiavello C., Gerace D., Bajoni D., and Gerace D., *arXiv preprint arXiv:2205.10429.*

2022 **Quantum neural network autoencoder and classifier applied to an industrial case study** Mangini S., Marruzzo A., Piantanida M., Gerace D., Bajoni D., and Macchiavello C., *arXiv preprint arXiv:2205.04127.*

2022 **The Dawn of Quantum Natural Language Processing** Di Sipio R., Huang J. H., Chen S. Y. C., Mangini S. and Worring M., *ICASSP 2022 - IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, 2022, pp. 8612-8616. *IEEE,*

2021 **Qubit noise deconvolution** Mangini S., Maccone L. and Macchiavello C., *arXiv preprint arXiv:2112.03043.*

2021 **Variational learning for quantum artificial neural networks.** Tacchino F., Mangini S., Barkoutsos P.K., Macchiavello C., Gerace D., Tavernelli I. and Bajoni D., *IEEE Transactions on Quantum Engineering* vol. 2, pp. 1-10, 2021, Art no. 3101110. *TQE,*

2021 **Quantum computing models for artificial neural networks.** Mangini S., Tacchino F., Gerace D., Bajoni D. and Macchiavello C., *EPL (Europhysics Letters)* **134**(1), 10002. *EPL,*

2020 **Quantum computing model of an artificial neuron with continuously valued input data.** Mangini S., Tacchino F., Macchiavello C., Gerace D. and Bajoni D., *Machine Learning: Science and Technology* **1**(4): 045008. *MLST,*

2019 **Continuous variable quantum perceptron.** Benatti F., Mancini S. and Mangini S., *International Journal of Quantum Information* **17**(08): 1941009. *IJQI,*

Experience

Qiskit Hackathon Europe: Research Study Groups
Online event organized by IBM

Participant — *Apr. 2021 - Jun. 2021*

- Project description: implement Quantum Reinforcement Learning based both on Grover's speedups and Variational circuits in Qiskit.
- The final version of the project is available on GitHub: https://github.com/stfnmangini/QRL.

Quantum Open Source Foundation (QOSF) Mentorship Program
Mentor: Antal Száva (Xanadu)

Mentee — *Oct. 2020 - Jan. 2021*

- Project description: Implement the architecture proposed in arXiv:1907.05415 using PennyLane and TensorFlow.
- The final version of the project is featured as a demo on PennyLane's website: https://pennylane.ai/qml/demos/learning2learn.html.

University of Trieste
Trieste, Italy

Stage — *Feb. 2019 - Apr. 2019*

- Topic: Continuous Variable quantum computation.
- Acquired the necessary skills and knowledge for an optical quantum generalization of a Perceptron, as discussed in my Master Thesis.

National Institute for Nuclear Physics (INFN)
Trieste, Italy

Internship — *Feb. 2017 - Mar. 2017*

- Topic: Neural Networks Simulation in Mathematica.
- Deepened my knowledge of Neural Networks and Wolfram's Mathematica, by programming, implementing and optimizing a neural network algorithm (Neural Relax) into Mathematica.

Talks

Summer School: Machine Learning for Quantum Physics and Chemistry
Online, Warsaw

Contributed Talk — *Aug. 2021*

Talk: *Variational Learning for Quantum Artificial Neural Networks*

Young Italian Quantum Information Science (YIQIS) 2020
Online event

Invited Speaker — *Sept. 2020*

Talk: *Quantum computing models for artificial neurons*

Teaching

Physics 1

Pavia, Italy

Teaching assistant

Mar. - Jun. 2021

Teaching assistant of Prof. Chiara Macchiavello for the course "Physics 1" in the BSc in Biology.

General Physics 2

Pavia, Italy

Teaching assistant

Oct. 2020 - Mar. 2021

Assistant of Prof. Lorenzo Maccone for the course "General Physics 2" in the BSc in Mathematics.

Extracurricular Activity

Scientific Divulgation

Multiple Locations

Speaker, Organization, Promotion

2014-ongoing

I find science outreach events very stimulating and funny, and I always look for opportunities to participate in such events. During the last few years, I took part in various divulgation events both as a speaker and organizer in Pavia (*Physics for Teenagers*, *Pillole di Sicenza*) and in Trieste (*Caffè dei Quanti*, *Italian Association of Physics Students* (AISF), *Mini-Maker Faire*, *Notte dei Ricercatori*). I wrote a short essay named *Il Grande Macello* on the importance of plant-based diets to address climate change, freely available for download on my personal website.

Student Representative

Trieste

Department of Physics

2019

- Student Representative for Master of Science in Physics in the University of Trieste.

Entrepreneurship

Trieste

Contamination Lab

2019

- Attended a School for University students in Trieste for promoting entrepreneurship and soft skills among students.