MATTEO **ROBBIATI**
Ph.D. in Physics

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Research interests

Quantum Computing • Quantum Machine Learning • Machine Learning • Optimization • Numerical Physics • Classical simulation of quantum systems • Quantum inspired numerical methods • High-Energy Physics • Matter Physics • Full-stack computation • Middleware development

Education

Ongoing	**Ph.D. in Physics**, European Organization for Nuclear Research (CERN), Switzerland.
2019 - 2022	**Master degree in Physics**, University of Milan, Italy.
2015 - 2019	**Bachelor degree in Physics**, University of Milan, Italy.

Experience

Jun. 2022 – Sep. 2016 | **Math and Physics lessons, Private lessons,**
- Private lessons in math and physics to high school students.

simplification of concepts | exposition | self-check

Dec. 2021 – Mar. 2021 | **Research and data analysis, Cooperative "La Valle di Ezechiele",**
- Studying social cooperatives' impact on getting prisoners back to work and lowering recidivism rates.
- Study of "*Social Impact Bonds*" as a financial instrument to support social welfare.
- Production of an explanatory report on the current conditions of the Italian prison system.

Data analysis | networking | social impact

Skills

GitHub	https://github.com/MatteoRobbiati.
Programming	Python, C/C++, HTML, CSS, Nextjs, BASH, LaTeX, Javascript.
Frameworks & libraries	NumPy, SymPy, SciPy, Scikit-learn, Keras, TensorFlow, PyTorch, JAX, Qibo, Qiskit, Cirq, PennyLane, MPI, Pandas.
Graphics & productivity	Inkscape, Xmind, Canva, Krita, GIMP, LaTeX, Matplotlip, Seaborn, Plotly, Microsoft Office suite.
OS	Linux, Windows.
Languages	Fluent in English and Italian, beginner in French and Spanish.

Softwares

Community-driven packages

Qibo	A full-stack framework for quantum computing, *(Core-developer)* `https://github.com/qiboteam/qibo`
Qiboml	A Full-stack hybrid classical-quantum machine learning framework, *(Core-developer)* `https://github.com/qiboteam/qiboml`
Qiboedu	Quantum computing educational activities using Qibo., *(Core-developer)* `https://github.com/qiboteam/qiboedu`
Qibolab	Quantum hardware module and drivers for Qibo., *(Contributor)* `https://github.com/qiboteam/qibolab`
Qibocal	Quantum calibration, characterization and validation module for Qibo., *(Contributor)* `https://github.com/qiboteam/qibocal`

Project-specific tools

QiNNtegrate	Multi-variable numerical integration via Quantum Machine Learning, *(Core-developer)* `https://github.com/qiboteam/QiNNtegrate`
adiabatic-fit	Probability density estimation via hybrid gate&analog-based quantum computing, *(Core-developer)* `https://github.com/qiboteam/adiabatic-fit`
rtqem	Real-time quantum error mitigation for variational optimization on quantum hardware, *(Core-developer)* `https://github.com/qiboteam/rtqem`
boostvqe	Boosting ground-states preparation with Double-Bracket Quantum Algorithms, *(Core-developer)* `https://github.com/qiboteam/boostvqe`
Kifit	A simulaton tool for New Physics search with (Non-)Linear King Plots, *(Core-developer)* `https://github.com/MatteoRobbiati/kifit (will be released soon)`
conditional PokeGAN	Generating conditioned Pokemon images via Generative Adversarial Network, *(Core-developer)* `https://github.com/MatteoRobbiati/Conditional-pokeGAN`

Publications

Peer-reviewed articles

2024 Qibolab: an open-source hybrid quantum operating system, *S. Efthymiou, A. Orgaz-Fuertes, R. Carobene, J. Cereijo, A. Pasquale, S. Ramos-Calderer, S. Bordoni, D. Fuentes-Ruiz, A. Candido, E. Pedicillo, M. Robbiati, Y. Paul Tan, J. Wilkens, I. Roth, J. I. Latorre, and S. Carrazza,* `Quantum 8, 1247.`

2024 Multi-variable integration with a variational quantum circuit, *J. M. Cruz-Martinez, M. Robbiati and S. Carrazza,* `Quantum Sci. Technol. 9 035053`

2024 Characterization of a Transmon Qubit in a 3D Cavity for Quantum Machine Learning and Photon Counting, *A. D'Elia, B. Alfakes, A. Alkhazaleh, L. Banchi, M. Beretta, S. Carrazza, F. Chiarello, D. Di Gioacchino, A. Giachero, F. Henrich, A. S. Piedjou Komnang, C. Ligi, G. Maccarrone, M. Macucci, Emanuele Palumbo 9,10 , A. Pasquale, L. Piersanti, F. Ravaux, A. Rettaroli, M. Robbiati, S. Tocci and C. Gatti* `Appl. Sci. 14(4), 1478`

Pre-prints (under review)

2023 Determining probability density functions with adiabatic quantum computing, *M. Robbiati, J. M. Cruz-Martinez, S. Carrazza,* `arXiv:2303.11346`

2023 Real-time error mitigation for variational optimization on quantum hardware, *M. Robbiati, A. Sopena, A. Papaluca, S. Carrazza,* `arXiv:2311.05680`

2024 Double-bracket quantum algorithms for high-fidelity ground state preparation, *M. Robbiati, E. Pedicillo, A. Pasquale, X. Li, A. Wright, R. M. S. Farias, K. Uyen Giang, J. Son, J. Knörzer, S. Thye Goh, J. Yong Khoo, N. H.Y. Ng, Z. Holmes, S. Carrazza, M. Gluza* `arXiv:2408.03987`

2024 Qibocal: an open-source framework for calibration of self-hosted quantum devices, *A. Pasquale, E. Pedicillo, J. Cereijo, S. Ramos-Calderer, A. Candido, G. Palazzo, R. Carobene, M. Gobbo, S. Efthymiou, Y. Paul Tan, I. Roth, M. Robbiati, J. Wilkens, A. Orgaz-Fuertes, D. Fuentes-Ruiz, A. Giachero, F. Brito, J. I. Latorre, S. Carrazza* `arXiv:2410.00101`

Proceedings of Science

2023 A quantum analytical Adam descent through parameter shift rule using Qibo, *M. Robbiati, S. Efthymiou, A. Pasquale, S. Carrazza,* `Volume 414 - 41st International Conference on High Energy physics`

2024 An open-source framework for quantum hardware control, *E. Pedicillo, A. Candido, S. Efthymiou, H. Sargsyan, Y. Paul Tan, J. Cereijo, J. Yong Khoo, A. Pasquale, M. Robbiati, S. Carrazza,* `arXiv:2407.21737`

2024 Beyond full statevector simulation with Qibo, *A. Pasquale, A. Papaluca, R. M. S. Farias, M. Robbiati, E. Pedicillo, S. Carrazza,* `arXiv:2408.00384`

2024 Strategies for optimizing double-bracket quantum algorithms, *L. Xiaoyue, M. Robbiati, A. Pasquale, E. Pedicillo, A. Wright, S. Carrazza, M. Gluza* `arXiv:2408.07431`

Teaching and educational contributions

Online course — **Quantum computing with Qibo**, *Centre of Quantum Technologies, Singapore*
`link to YouTube playlist of the course`

On-site course — **Minicourse on quantum computing**, *ICTP, Sao Paulo, Brazil*
`link to YouTube playlist of the course`

Partecipation in research grants

2021 – 2022 — **Collaborator**, *Automatic Monte Carlo on GPU*, Linea 2A, University of Milan.

Partecipation in conferences and workshops

Nov. 2022 — **Quantum Technologies for High-Energy Physics**, CERN, Geneve
Mar. 2023 — **Openlab Technical Workshop**, CERN, Geneve
Jun. 2023 — **Quantum Technologies (Computing, Sensing and Simulation)**, INFN, Turin
Nov. 2023 — **Quantum Techniques in Machine Learning**, CERN, Geneve
Mar. 2024 — **American Physical Society March Meeting**, Minneapolis, USA
Mar. 2024 — **22nd International Workshop on Advanced Computing and Analysis Techniques in Physics Research**, Stony Brook University, New York, USA
Nov. 2024 — **Tensor Networks and (Quantum) Machine Learning for High-Energy Physics**, CERN, Geneve
Jul. 2024 — **Python in HEP users workshop**, Online

Contributions in Schools, Conferences, Workshops and Meetings

May 2023 — **`Poster`: Determining probability density functions with adiabatic quantum computing**, EQAI2023, *Udine*
Jun. 2023 — **`Poster`: qibo: a full-stack framework for simulation, control and calibration of self-hosted qubit devices**, Workshop INFN CSN4&5, *Torino*
Jul. 2023 — **`Lecture`: Quantum Computing and Quantum Machine Learning tutorial**, Advanced Artificial Intelligence for precision High Energy Physics, *Como*
Nov. 2023 — **`Poster`: Determining probability density functions with adiabatic quantum computing**, QTML2023, *CERN*
Nov. 2023 — **`Poster`: Real-time error mitigation for variational optimization on quantum hardware**, QTML2023, *CERN*
Dec. 2023 — **`Talk`: Full-stack Quantum Machine Learning for High Energy Physics**, Milan Christmas Meeting 2023, Milan
Jan. 2024 — **`Talk`: Full-stack Quantum Machine Learning using Qibo**, Singapore Quantum Tech Meetup, Singapore
Mar. 2024 — **`Talk`: Full-stack Quantum Machine Learning in High Energy Physics**, APS March Meeting 2024, Minneapolis, USA
Mar. 2024 — **`Talk`: Real-time error mitigation for variational optimization on quantum hardware**, ACAT 2024, Stony Brook University, New York, USA
Mar. 2024 — **`Talk`: Quantum Machine Learning in High Energy Physics with Qibo**, PyHEP workshop, Online

Outreach and Volunteering

2022 – 2016 — **Scout educator, AGESCI,**
› ability to interact constructively with the group, problem solving.
team-work | adaptation | interplay | relationship | challenge

2022 – 2019 — **Volunteer, Apwoyo ONLUS,**
› menagement of stressful situations, emphaty.
team-work | empathy