Michele Grossi

Senior Researcher - Quantum Science Technology & Research Innovation

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BIOGRAPHICS

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INTRODUCTION

I am a senior fellow in quantum computing and algorithm at CERN. I received my industrial PhD in High Energy Physics from the University of Pavia working on quantum machine learning models for boson polarisation discrimination. I have worked for several years as Quantum Technical Ambassador and Hybrid Cloud solution Architect at IBM. In my current role at CERN I lead a group of researchers focusing on application of quantum algorithm. I'm the Coordinator of the Hybrid Quantum Computing Infrastructures and Algorithms competence centre. My focus is the development of Quantum Machine Learning pipelines for High Energy Physics problems and beyond, in collaboration with industries and universities.

WORK EXPERIENCE

Hybrid Quantum Computing Infrastructures and Algorithms Coordinator — 01/2024 – Ongoing
CERN — *Geneva, Switzerland*

Coordinating and supervising of Quantum Computing projects at CERN. Responsible for the Hybrid Quantum computing and Algorithm Competence Center. Main research topics are quantum machine learning and the investigation of distributed quantum computing, development of hybrid classic-quantum algorithms pipeline for theoretical experimental physics and beyond, simulation of high dimensional classical and quantum systems. With a special focus on IT Hybrid Infrastructure, the objective is to develop and interconnect HPC and Quantum Computing from algorithm, software and middleware point of view. Supervision of PhD students and research projects is a fundamental part of this job, as well as building collaboration with industry and universities.

Senior Fellow Quantum Computing Researcher — 09/2021 – 12/23
CERN — *Geneva, Switzerland*

Supervisioning Quantum Computing projects at CERN. Development of Quantum Machine Learning pipelines for High Energy Physics and their usage in research and industry. Quantum algorithm development for NISQ and fault tolerant regimes. Supervision of PhD students and research projects.

Hybrid Cloud Architect — 01/2021 – 08/2021
IBM Italia s.p.a. — *Milan, Italy*

Co-create with partners by developing frameworks and integrated solutions built on IBM technology and other main technological providers. Support customer hybrid cloud adoption and provide hands-on assistance to partners to facilitate solutions building. Develops the framework and leads all aspects of an integrated solution from the infrastructure, to the platform and services needed. Use contemporary technologies and approaches to develop and deliver **Cloud-based solutions, IaaS, PaaS, SaaS, blockchain and quantum computing**. Translates business problems into leading-edge analytic solutions.

IT Client Technical Solution Architect — 04/2019 – 12/2020
IBM Italia s.p.a. — *Milan, Italy*

As a Solution Architect an IBM Quantum Ambassador for IBM Italy Ecosystem I am working in designing concepts and principles required to develop multi-layer enterprise architectures and infrastructure components in a context that pushes towards accelerate **digital transformation**. I am involved in use case scenario with customer to evaluate up to date technology utilization from **artificial intelligence to quantum algorithm** proof of concept and supporting Cloud adoption providing the right support from the infrastructure to services.

IT Network Infrastructure Architect **11/2017 – 03/2019**
IBM Italia s.p.a. *Milan, Italy*

In this role I expand my knowledge in network design concepts and principles required to develop multi-layer enterprise architectures and network components. Main goals are using advanced IP addressing and routing in implementing scalable and highly secure routers that are connected to LANs, WANs, and IPv6. Planning, configuring, and verifying the implementation of development in network design and technologies, including L2 and L3 infrastructures for the enterprise, WAN technologies, data center integration, with focus on network security and network services. I am responsible for important national and international customer with decision-making role.

Network Account Manager **10/2016 – 10/2017**
IBM Italia s.p.a. *Milan, Italy*

In this role I have to ensure network performance, security, compliance and cost management in various infrastructures. It includes developing managerial skills in the role of networks account manager, following various projects including relationships with business partners that provide network services to IBM outsourcing customer.

Apprenticeship **01/2015 – 09/2016**
IBM Italia s.p.a. *Milan, Italy*

Within the IT area, in the first period my role is network specialist, focusing on deepen my knowledge about the network area, working to get various certifications and experience in the day by day activities. On one side the role is purely systems engineering regarding management of network structure of large companies, monitoring and managing related changes and incidents. In the second part I move toward Industry 4.0 scenario in which I am involved in **Internet of Things** initiatives. This area requires skills in manipulating customer data from several industrial devices. It is a wide area where network, cloud, big data and IT security is crucial. I am involved in developing innovative data manipulation algorithm, creating demo application as well as complex project.

Scholarship **07/2014 – 12/2014**
Istituto Nazionale di Fisica nucleare INFN *Pavia, Italy*

Goal of this scholarship was to coordinate INFN activities of a working group in Pavia having led to the construction of a Micromegas detector. The activity was about the design of the detector in its details, starting from its mechanical construction, to the implementation of its electronic components and their validation tests. Moreover, I realized several applications in LabVIEW which handled the construction and the tests of the detector. All the process of construction has ensured uniformity and reproducibility necessary for mass-production needed for the whole ATLAS Experiment.

EDUCATION

Industrial PhD in Physics **10/2017 – 04/2021**
University of Pavia - IBM Research *Pavia, Italy*

Supervisor: Prof. D.M. Rebuzzi (Pavia) I. Tavernelli (IBM)

Thesis: *W Boson Polarization Studies for Vector Boson Scattering at LHC: from Classical Approaches to Quantum Computing*

This **executive** (industrial) PhD is a combined high-level education path in collaboration between industry and university. It aims at acquiring a deep knowledge in **data science** and **quantum computing**, taking advantage of a physics use-case to learn how to use and develop cutting-edge big data analytics concepts, skills and tools. This use case is called Vector Boson Scattering: an extreme rare process that is the ideal process for a model-independent test-bench of new physics at energy scales never investigated before. The European Community has appointed the study of the VBS as one of the top priorities for the High energy physics scenario at CERN. My role is to develop the understanding of the **modelling and simulation** of real-life big datasets, of the data analysis and filtering, and of their statistical handling and interpretation to extract condensed meaningful information, to be used in predictive and prescriptive modelling. My role is to develop the understanding of the modelling and simulation of real-life big datasets, of the data analysis and filtering, and of their statistical handling and interpretation to extract condensed meaningful information, to be used in predictive and prescriptive modelling. I support customers in evaluating the latest technology utilization, ranging from machine learning to quantum computing, and I collaborate with research institutions, among them IBM Research and CERN.

MSc Thesis **07/2013 – 12/2014**

Thesis: Study and development of MicroMegas detectors for the upgrade of ATLAS experiment *Pavia, Italy*

Supervisor - Gabriella Gaudio **Final Grade - 110/110 cum laude**

Within the ATLAS EXPERIMENT the thesis focuses on Development and construction of a Micromegas detector for the upgrade of the muon detector. I have been involved in the development and construction of a MicroMegas mechanical prototype. In particular I have developed complete software in LabView to manage every stage of the production chain: from the handling of planarity checks of PCB layers up to the implementation of a complete control panel to execute an automatic glueing procedure and data control.

BSc in Particle Physics **12/2011**

Thesis: CUORE: Un esperimento per lo studio del decadimento $\beta\beta0\nu$ *Pavia, Italy*

Supervisor - Andrea Fontana

SKILLS

- **Quantum Computing** Qiskit, PennyLane, QIBO
- **Machine Learning** scikit-learn, Jax, Keras
- **Programming Language** Python, C++, R
- **Cloud Technologies** IBM, AWS, Google
- **Scientific Language** LaTeX
- **Languages** Italian (mother tongue), English (C1), French (B1)
- **Soft Skills** organization of conferences, public speaking (scientific and C-level)

PUBLICATIONS

Updated list of publications **07/2024**

- Google Scholar
- Personal Website

SELECTED INVITED TALKS

World AI Cannes Festival **08/02/2024 – 24/11/2023**

CERN *Geneva, Switzerland*

Quantum Computing Research Ecosystem : Government and Academia Perspective. Representatives from top research institutions discussed where we stand on the roadmap for developing commercialy viable quantum computers, and what efforts governaments and reseach centres are making to move ahead.

CONFERENCE COMMITTEE and ORGANIZATION

QT4HEP22 International Conference **01/11/2022 – 04/11/2022**

CERN *Geneva, Switzerland*

The conference explores Quantum Technology in the context of High Energy Physics, featuring talks on quantum simulation (lattice gauge theories and neutrino physics), quantum computing (simulation of particle collisions), quantum sensing (dark matter detection), and quantum communication (data transferring from hep experiments). Speakers include experts from both academia and industry. A small list follows:

- **Joseph Lykken** - Fermilab Quantum Institute
- **Alessandro Roggero** - University of Trento
- **Piet Schmidt** - Institute for Experimental Quantum Metrology
- **Vedran Dunjko** - Leiden University

- **Giuseppe Carleo** - EPFL
- **Jay Gambetta** - IBM Quantum
- **Gian Giacomo Guerreschi** - Intel

QTML2023 International Conference

19/11/2023 – 24/11/2023

CERN *Geneva, Switzerland*

Quantum Techniques in Machine Learning (QTML) is an annual international conference focusing on the interdisciplinary field of quantum technology and machine learning. The goal of the conference is to gather leading academic researchers and industry players to interact through a series of scientific talks focused on the interplay between machine learning and quantum physics.