Giuseppe Di Molfetta

Full Professor of Computer Science

HDR in Computer Science
PhD in Theoretical Quantum Physics

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Speaks Italian, French, English, C, C++, Fortran, Python.
Born on the 29th of July 1985, Bari (Italy)
2 childrens (Arturo and Viola)

Current position

Aix-Marseille Univ./ Professor (PU)
2022 –today
Research at the Laboratoire d'Informatique et Systèmes.
Teaching ~220hrs/y. at the DII and the DP

Previous positions

Aix-Marseille Univ./Lecturer (MCF)
2016–2022
Research at the Laboratoire d'Informatique et Systèmes.
Teaching ~220hrs/y. at the DII.

Universidad de Valencia/PostDoc
March 2016 - Septembre 2016
including one month visiting at Perimeter Institute (Waterloo, Canada).

Degrees

Aix-Marseille Université/Habilitation à Diriger les Recherches
2020 *(17.12.2020)*

Title: **Quantum Walks, limits and transport equations.** Jury: Emmanuel Jeandel (LORIA, referee), Renato Portugal (LNCC, referee), Jingbo Wang (UWA, referee), David Meyer (UCSD), Olivier Bournez (LIX, IPP), Hachem Kadri (LIS, AMU), Pablo Arrighi (LFM, Saclay Université), Eric Cances (Ecole de Ponts, Paritech).

Sorbonne Université/PhD
2012-2015 *(28.07.2015)*

Teaching ~64 hrs/y at the Physics Department
Title: **Quantum Walks : from gauge field to thermalization.**

Supervisors: Fabrice Debbasch (Sorbonne) and Marc Brachet (ENS). *Jury:* Jean Michel Raimond (LKB, ENS, president), Dieter Meschede (University of Bonn, referee), Pablo Arrighi (Aix-Marseille Université, referee), Yutaka Shikano (Chapman University and IMS). Viva : July 2015. **Distinction : Very Honorable, with Committee Praise.** Funded by EDPIF & JSPS.

Paris School of Economics & Paris 1/MSc Theoretical Economics
2013–2014 Dissertation on Agent Based Models for Macroeconomics.

Sorbonne Université, Paris-Saclay, Sorbonne Université and Université de Paris, together with Politecnico di Torino, SISSA and ICTP in Trieste/MSc Theoretical Physics of Complex Systems (taught in english)
2010–2012 including a semester at SISSA (2012)

Sapienza University/BSc Physics
2006–2010

Liceo Statale Scientifico Enrico Fermi/Italy, Bari
1999-2003

Main research leaves

LIS/CRCT (6 months)
2025/2026
Teaching ~64 hrs at the DII.

LIS/Délégation CNRS (100%)
2021/2022
Teaching ~64 hrs at the DII.

Keio Univ. Quantum Computing Center/JSPS Bridge Fellowship
February-March 2020 (shortened due to pandemics)
short research visiting at the IBM Quantum Computer Center.

NINS, Okazaki/JSPS Summer Program
July-August 2014
PhD-level. Two months-long research visit in the Shikano Group, at the IMS.

Responsibilities

CoNRS Sec. 2/Member of the national committee for scientific research **2025-2029 (elected)**
The National Committee for Scientific Research (CoNRS) is a collective body comprising the Scientific Board, Institute Scientific Boards, specialized sections in each discipline, and Interdisciplinary Commissions. The CoNRS plays a key role in French science.

CoNRS Sec. 2/Board member
2025-2029 (nominated)

CSI Sciences Informatiques/Member of the national council
2021-2023 (elected) 2024-2028 (nominated)
The CSI is key to the scientific policy of the "Institut de sciences informatiques (ex-INS2I)", which has been coordinating CNRS research in the fields of computer science, control, signal and image processing, robotics and chip systems design.

AMU/Member of the group of experts aiming to define the AMU scientific perspective for 2040. Responsible for the whole computer science area, proposed by the AMU president.
2025

AMIDEX-AMU/Expert mission for the national acceleration strategy (SNA) "Quantum technologies", *HUB France 2030*.
2024-2030

MER (Mission Europe pour la Recherche**)**/Member of the group of experts "Digital, TIC", responsable on quantum technologies area.
2024 – today

LIS - Conseil du Laboratoire/Elected member
2024 – today

LIS UMR7020/Doctoral fellowship selection committee elected council member
2021/2022

Archimede Institute/Doctoral fellowship selection committee nominated member
2021/2022

Aix-Marseille Univ./Head of the 1st year in Informatics/Mathematics/Physics/Mechanics (Portail Descartes) at Luminy campus
2018 – 2021 *Former member of the committee that designed the new program for the shared first year in Informatics/Mathematics/Physics/Mechanics.*

Aix-Marseille Univ./Head of the 1st year in Informatics at Saint Charles campus
2017/2018

Selection committee member
2025 Selection CPJ Saclay Université [member of the committee]
2025 Selection CPJ CNRS [member of the committee]
2025 Selection CRCN/ISFP Inria Nancy [member of the committee]
2025 Aix-Marseille Univ. for MCF (Lecturer, permanent position) sec. 27 (computer science) [President of the committee]
2024 Aix-Marseille Univ. for MCF (Lecturer, permanent position) sec. 27 (computer science) [member of the committee]
2024 Saclay Univ. for Lecturer (CDI) sec. 27 (computer science)
2022 Aix-Marseille Univ. for MCF (Lecturer, permanent position) sec. 27 (computer science) [member of the committee]

Lab seminar organization
2022–today **Resp. du Groupe de Travail Informatique Quantique/LIS** **2018–2023** **LIS (UMR7020) > Pôle calcul**
2017 **LIF (UMR7279))**

Scientific production

46 publications, see a more up-to-date list

39 international-level refereed journals including *Quantum Information Processing*, *Quantum*, *Physical Review Letters*.

2 published books

Research aims

Distributed quantum computational models, towards quantum simulation and distributed algorithms on fault-resilient architectures, with application from physics to machine learning.

Multi-scale quantum simulation, towards quantum and hybrid model of computation with application to noisy intermediate scale quantum computing.

Natural algorithms, seeking natural quantum systems spontaneously implementing known algorithms or suggesting new computational paradigms.

Scientific recognition

Prizes

2025-2028 RIPEC C3 ex-PEDR, Prime d'Encadrement Doctorale et de Recherche

2025-2026 Partial release from teaching obligation (96 hours per academic year) from Aix-Marseille Université (CRCT)

2022-2025 Partial release from teaching obligation (96 hours per academic year) from Aix-Marseille Université and financed by ANR (France)

2020-2024 PEDR, Prime d'Encadrement Doctorale et de Recherche

2019 Japan Society for the Promotion of Science - JSPS Bridge Fellowship

2016 Prix de la Ville de Marseille (MLR/IP N 2016/165)

2014 Japan Society for the Promotion of Science - JSPS Fellowship

Organizing Committee

Avril 2025 Mathematics and Physics of Quantum Learning Summer School, IGESA, Porquerolles, France

September 2023 Chair of Quantum Days @AMU, CIRM, Marseille, France

September 2022 Co-chair of Quantum Machine Learning, at the European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in Databases (ECML-PKDD)

Jan. 2020 Co-chair of QSQW20 9th International Conference on Quantum Simulation and Quantum Walk (~100 pers., CIRM, Marseille)

Jan. 2019 Co-chair of Machine Learning and Quantum Computation, Aix Marseille Université

June 2017 Chair of Quantum Simulation Models Workshops, LIS, Marseille

Program/Scientific Committee

August 2025 QC-Horizon : Quantum Informatics, Computing and Technology, scientific committee member, University of West Bohemia, Prague, Czech Republic

July 2024 European Quantum Technology Summer School, scientific committee member, Strasbourg, France

July 2024 Research Schools on Quantum Random Channels, scientific committee member, CIRM, Marseille

July 2023 UAI 2023, program committee member, Pittsburgh, USA

July 2023 Summer School "Information quantique, matrices aléatoires et intrication quantique. Chaire-Jean Morlet", scientific committee member, CIRM, Marseille

June 2017 Quantum Simulation Models Workshops, LIS, Marseille, France

PhD/Written report and jury member

2025 Surajit Saha (The University of Calcutta) [referee]

May 2025 Peiyong Wang (The University of Melbourne) [referee]

October 2024 Raphaël Mothe (Université de Grenobles-Alpes) [referee]
Juin 2024 Arthur BRAIDA (Université d'Orleans) [president]
July 2023 Nur Izzati BINTI ISHAK (Malaya University, Kuala L.) [referee]
February 2023 Yuan YAO (IQA, Telecom Paris, Paris) [president]
November 2022 Kevissen Sellapillay (AMU, Marseille)[member]
September 2022 Nathanael Eon (AMU, Marseille)[member]
December 2019 Ivan Marquez (AMU and UVA, Valencia)[member]
April 2018 Pedro Costa (CBPF, Rio de Janeiro)[member]

Journal reviewer

For Nature Communications, Nature Physics, QINP, QIC, TCS, PRX Quantum, PRL, QLP, Royal Society, Quantum, NJP, QIC, PRA, PRE, Letters in Mathematical Physics.

Grant proposal reviewer

2024 Evaluation PEPR Technologies Quantiques project, ANR France

Editorial Board member

Editorial board member in **1024** (bulletin SIF) and **Quantum Engineering and Technology** (Frontiers).
Guest editor for **EPTCS**, special volume IX International Conference on Quantum Walks and Quantum Simulation; **Entropy.** Special Issue: Quantum Walks : Applications and Fundamentals; **Frontiers in Physics**. Special Issue : Models of Distributed Quantum Computation.

Selected research invitations

12/2025 Visiting Researcher at LNCC, Rio de Janeiro, Brésil
05/2023 Visiting Researcher, within a four-week research programme at MIAPbP | Granted and founded by the Munich Institute for Astro-, Particle and BioPhysics, Germany;
03/2020 Visiting Researcher, founded by the JSPS BRIDGE program at the Quantum Computing IBM center, Keyo Univ., Tokyo, Japan;
06/2019 Visiting Researcher, IFIC, Valencia, Spain
10/2018 Visiting Researcher, CBPF, Rio de Janeiro
09/2018 Visiting Researcher, ICQ, Waterloo
09/2014 Visiting Researcher, founded by the JSPS Summer program at the Quantum Computing IBM center, Keyo Univ., Tokyo, Japan;

Scientific diffusion

1 article in 1024 Bulletin de la SIF (n°18)

My work has sometimes been commented upon by others, e.g. in MIT Technology review.

HDR/Post-Doc/PhD supervisions

Post-Doc supervisions

Cameron Calk (2024– 2026, Post-doc) on quantum distributed memory on arbitrary graphs. Co-supervised with Emmanuel Godard.

Alexei Toumi (2022– 2023, Post-doc) on quantum agents and semantics, with Pierre Clairembault, now research scientist for Planting Space in Paris and Cambridge Quantum Computing

Etienne Moutot (2021– 2022, Post-doc) on quantum tessellation, now CNRS researcher at I2M, Marseille

Quantum tiling as a model of "space-time" manifold computation. The main idea is to build bridges between the more physical notions of space-time continuum, and the more computational ones already present in categorical quantum calculation (an example of which is ZX-calculation)

Stefano Facchini (2016–2017, ATER) on quantum walks, now research fellow at UCL, London

Quantum walks are the quantum analogues of the classical random walk. They are a primitive for universal quantum computing. Here they are used to compute spacetime geodesics on arbitrary metrics, using a finite number of quantum local operations.

PhD supervisions

Alana Spak dos Santos (2024–, UFPR, 50%, co-directed with Renato Moreira Angelo, PU UFPR) on Thermalization and equilibration via quantum walks in energy space

Niccolo Fonio (2023–, AMU, 50%, co-directed with Pierre Sagaut, PU AMU) on Quantum methods for fluid dynamics

Ugo Nzongani (2023–, AMU, 50%, co-directed with Andrea Simonetto, PU ENSTA) on Noisy Variational Quantum Circuits and Optimisation

Andrea Mammola (2023–, AMU, 50%, industrial project CIFRE with C12) on Physical realization of gauge invariant quantum cellular automata

Xiayou Sun (2022–, AMU, 50% co-directed with Hachem Kadri, PU AMU) on Noisy Distributed Quantum Computing and machine learning

Mathieu Roget (2022–2025, AMU, 100%) on Distributed Quantum Computing

Quantum Search is an ubiquitous sub-routine in quantum algorithms. Here a Quantum Walks based scheme is investigated in several mathematical frameworks, especially complex networks.. Moreover a generalisation to multi-qubits led to a distributed and fully local quantum algorithm to solve oracular problems..

Casale Balthazar (2020–2023, AMU, 50%, co-directed with Hachem Kadri, PU AMU) on Quantum techniques in machine learning

Quantum algorithms have been introduced to recover quantum speed up with respect to classical learning algorithms, such as the quantum perceptron or the quantum best arm identification.

Kevissen Sellapillay (2019–2022, AMU, 50%, co-directed with Alberto Verga, PU AMU) on QCA and topological properties, now post-doc in Jülich

Quantum cellular automata can thermalize. Here we prove that there exist classes of quantum cellular automata which do not fully thermalize and break the ergodic hypothesis, leaving parts of the Hilbert space topologically protected. This paves the way to use such systems as fault-resistant quantum computers.

Nathanaël Eon (2019–2022, AMU, 50%, co-directed with Pablo Arrighi, DR INRIA) on Gauge-invariant quantum cellular automata now on a humanitarian mission

Gauge invariance is an internal symmetry well known in physics. All fundamental laws are derived from a gauge principle. Here we define gauge invariant classical and quantum cellular automata for simulating real systems.

Ivan Marquez (2017–2019, AMU & Univ. de Valencia, Spain, 50%, co-supervised with Armando Perez, PU UV) on Quantum walks: background geometry and gauge invariance. now cybersecurity consultant at Evolution Empowering the Cloud in Madrid

Quantum walks can simulate curved propagation. Here we investigate the formal connections between general covariance, the first principle for general relativity, and quantum walk, seen as finite quantum circuits.

Graduated (M2) internship supervisions

Niccolo Fonio (2023, Politecnico di Torino, 50%), Quantum circuits for hydrodynamics with Pierre Sagaut

Anirban Ganguly (2022, AMU, 50%), Black hole evaporation in terms of quantum circuits with Federico Piazza

Mathieu Roget (2022, ENS Lyon, 100%), Optimality and quantum advantage for spatial search with multiple items.

Mathieu Roget (2021, ENS Lyon, 50%), Quantum perceptron with H. Kadri.

Julien Zylberman (2021, ENS Paris - MIT, 50%), Hybrid quantum algorithms for nonlinear PDE with F. Debbasch and Nuno Loureiro

Thomas Usimaki (2021, AMU, 80%), Fault tolerant LOCAL distributed algo with F. Legall & E. Godard.

Basile Herzog (2020, ENS Cachan & UPMC, 100%), Search algorithms, now PhD candidate at LATMOS, Univ. de Lorraine.

Odilon Duranthon (2020, ENS, 100%), Coarse-graining QCA. Now PhD candidate at Lausanne Univ.

Varelogiannis Sokratis (2020, Ecole Polytechnique, 50%), Quantum QR code, with P. Arrighi.

Nathanael Eon (2019, AMU, 50%), Non-abelian gauge invariant CA, with P. Arrighi. Now PhD AMU.

Alan Gardin (2019, IMT Brest, 100%), Quantum dynamical graphs and universality. Now PhD candidate Univ. of Adelaide

Karmouda Ouafae (2019, AMU, 50%), Quantum embedding, with H. Kadri. Now PhD candidate at Université de Lille

Casale Balthazar (2019, AMU, 50%), Quantum bandit, with H. Kadri. Now PhD candidate AMU.

Kevissen Sellapillay (2019, AMU, 100%), QED - quantum simulation. Now PhD candidate AMU

Adrian Maquet (2018, AMU, 50%), QWs and Fault Tolerant Computation, with F. Debbasch.

Mohamed Hatifi (2017, ENS Paris, 50%), with M. Brachet. Now a researcher at OIST, Okinawa.

Ivan Marquez (2016, AMU, 50%), Non-Markovian QWs and localisation, with A. Perez. Now Cyber Security Engineer, BOTECH

Collaborative networks & grants

ANR JCJC on Quantum Distributed Computing (DisQC) /ANR National grant/Coordinator (270k€) + **AMIDEX interdisciplinary grant** (100k€)

2022–2026

The project proposes to study the application of quantum walks, quantum cellular automata and their extensions to graphs, in the framework of the development of medium-term quantum computers. The overall goal of the project is to understand how to design and to control efficient and scalable circuits and algorithms on distributed architectures, with a particular focus on the fault-tolerance of quantum information processing and the infrastructure itself. In the short term, one of the pivotal aspects of the project is to understand how errors propagate in the aforementioned models. In the medium and long term, the goal is to provide effective, scalable and fault-tolerant algorithms and software to optimize them.

PEPR on Quantum Technologies (EPiQ) /ANR National grant/PI and Local leader

2022–2028

Member of the consortium of the large scale national initiative on quantum technology. I am the local leader of the consortium. The ~300k€ (HT) grant will fund a two year postdoc on formal methods and a three years PhD on quantum distributed algorithms.

Quantum Information Structure of Spacetime (QISS)/JTF Large grant/PI

2019–2022/2023–2026

14 site international consortium made of the top researchers, worldwide. I was PI for the LIS partner in the first phase (2019–2022) and I am associated with the second phase (2023–2026).

Stochastic Thermodynamics and Information in Quantum Walks/FAPERJ, PI

2025/2026

International mobility program between the CBPF (Silvio Duarte Queiros) and my lab UMR 7020 LIS, to investigate thermodynamics in quantum walks based systems.

Discrete Time Quantum Simulator/AMIDEX, Leader

2019–2021

The project was the only one selected in the computer science area with a great interdisciplinary vocation. The general objective of DiTiQuS project was to use Quantum Cellular Automata as platforms to describe quantum systems and their dynamics in different levels of characterizations.

Other international grants*/Leader*

2018–2021 **Quantum Walk and geometry**/PICS CNRS France-Spain. I initiated this

new international collaboration between UV and AMU.

***Other national networks grants**/Leader*

2021 **Fault invariant distributed quantum algorithms** with I2M/INS2I
2018 **Lattice Quantum Simulation Theory** with UPMC/INFINITI CNRS
2017 **Quantum Networks and growing** with Filippo Miatto (LTCI Paris)/INS2I

***Other national networks grants**/Member*

2019–2021 **Quantum Machine Learning** at LIS/ANR JCJC

CNRS research networks/Member

GdR IM > GT Quantum Informatics, GdR TEQ (ex IQFA)

Teaching > graduates

Research schools/Master & PhD level

2026 (to come) Quantum Circuits for Hydrodynamics Simulations (OTAN, von Karman Institut, Belgium)
2024 Quantum Circuits for Hydrodynamics Simulations (OTAN, von Karman Institut, Belgium)
2022 Quantum natural computing: from simulation to algorithms, (ECI22, UBA, Argentina)
2022 Quantum Boltzmann Machines (OTAN, von Karman Institut, Belgium)

Courses/Master level & PhD level

2023/2024 Quantum Algorithms (ED184, AMU)
2021/22 Quantum Machine Learning (ED184, AMU) with Hachem Kadri
Since 2024 Introductory Quantum Computing for IA (M2, Ecole Centrale de Marseille)
2024/2025 Advanced Quantum Computation and Information (M2, AMU) with Ravi Kunjwal
2023 Quantum Machine Learning (M2, AMU)
2021/22 Quantum Cryptography (M2, AMU)
Since 2016 Models of Natural Computing (M2, AMU)
2020/21 Computer security watch (M2, AMU)
Since 2026 Quantum information and applications (M1 Physics, AMU)
2018/19 Security, Internet, Networks, ~20 students/y. (M1, AMU)
Since 2018 Quantum Computation, ~20 students/y. (M1, AMU)
2016– 2020 Complexity Theory (M1, AMU)

Teaching > undergraduates

Courses/Undergraduate level

2024/2025 Remise à niveau en informatique (L3, AMU)
2022–2024 Algorithmics 1 (L2, AMU)
Since 2022 Introduction to quantum computing (L2, MPCI, AMU)
2018–2021 Probability for computer scientists (L2, AMU)
2016–2021 Introduction to informatics (L1, AMU)