

Francesco Arzani

Researcher in quantum information and quantum optics



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🌐 frarzani.github.io/

Academic and professional experience

- 09/2023–current **Junior professor**, INRIA Paris and École Normale Supérieure – Paris, France, QAT team
- 05/2021–current **Consultant**, Xanadu Quantum Technologies – Toronto, Ontario, Canada (remote)
- 09/2020–08/2023 **Post-doctoral researcher**, Freie Universität Berlin – Quantum information theory, quantum many-body theory, and quantum optics group,
Supervisor: Prof. Jens Eisert
- 10/2018–10/2019 **Post-doctoral researcher**, MOCQUA team – Loria, Nancy & Quantum Information group – Laboratory of Informatics of Paris 6,
Supervisors: Dr. Damian Markham, Dr. Simon Perdrix
- 04/2018–9/2018 **Post-doctoral researcher**, Université Paris Diderot & Paris center for quantum computing,
Supervisors: Dr. Damian Markham, Dr. Iordanis Kerenidis

Education

- 01/2015–03/2018 **PhD in Physics**, École Normale Supérieure, Paris; Kastler Brossel Laboratory,
Thesis: “Measurement-based quantum information with optical frequency combs”,
Supervisors: Prof. Nicolas Treps & Prof. Claude Fabre
Funding: Paris Sciences Lettres Research University
- 10/2012–12/2014 **Master’s degree in Theoretical Physics**, Università degli Studi di Pavia,
Master’s thesis: “Measurement-based quantum information with optical frequency combs”,
Supervisor: Prof. Chiara Macchiavello; Co-supervisors Prof. Nicolas Treps & Dr. Giulia Ferrini
Grade: 110/110 cum laude (with honours)
- 02/2014–08/2014 **Master’s internship**, Quantum Optics group – Kastler Brossel Laboratory, Université Paris 6
Pierre et Marie Curie
- 09/2013–07/2014 **ERASMUS exchange period**, Université Paris 6 Pierre et Marie Curie
- 09/2009–10/2012 **Bachelor’s Degree in Physics**, Università degli Studi di Pavia,
Bachelor’s thesis: “An informational approach to quantum thermodynamics beyond the von Neumann Regime”,
Supervisor: Dr. Paolo Perinotti
Grade: 110/110
- 2009 **High school diploma**, Liceo scientifico tecnologico, IIS “Guglielmo Marconi”, Tortona
Grade: 100/100 cum Laude (with honours)

Grants, awards, fellowships

- 03/2025–02/2028 **ANR-PRCI**, Franco-German collaborative research grant on Bosonic Lattice Codes (BoLaCo),
French coordinator, partnered with Freie Universität Berlin
- 09/2020–08/2022 **Humboldt postdoctoral fellowship**, Freie Universität Berlin
- 09/2009–07/2015 **Student at IUSS**, Istituto Universitario di Studi Superiori, Pavia
- 09/2009–07/2014 **Student at Collegio Ghislieri**, Pavia, Residence for university students with merit based admission

Teaching and outreach

- 10/2024–02/2025 **Instructor**, École Normale Supérieure – Paris Sciences Lettres ,
Quantum computing (M2), Quantum engineering master

- 10/2023–02/2024 **Instructor**, *École Normale Supérieure – Paris Sciences Lettres*,
Quantum programming (M2), Quantum engineering master
- 11/2021–03/2022 **Teaching assistant**, *Freie Universität Berlin*,
Quantum information (Master's level)
- 11/2019 **Fête de la Science**, *Sorbonne Université*,
Presentation of quantum information to high school students
- 09/2018–12/2018 **Teaching assistant and lab demonstrator (Vacataire)**, *Université d'Évry val d'Essonne*,
Introduction to experimental physics (Bachelor's level)

Academic reviewing

Phys. Rev. Lett., Phys. Rev. A, Quantum Journal, JOSA B, Eur. Phys. J. D, Optics Express, QIP (conference)

Languages

Native Italian
Fluent English, French
Basic German

Computer Skills

Operating Unix/Linux, Windows
systems
Programming Mathematica, Python, Julia, C++
languages

Publications

Preprints

- *Towards fault-tolerant quantum computation with universal continuous-variable gates*
S. Blair, **F. Arzani**, G. Ferrini, A. Ferraro (arxiv:2506.13643).
- *Can effective descriptions of bosonic systems be considered complete?*
F. Arzani, R. I. Booth, U. Chabaud (arxiv:2501.13857).

Journal articles (peer reviewed)

- *Exploiting symmetry in variational quantum machine learning.*
J. J. Meyer, M. Mularski, E. Gil-Fuster, A. A. Mele, **F. Arzani**, A. Wilms, J. Eisert
Physical Review X Quantum 4, 010328 (2023). (arxiv:2205.06217).
- *Gottesman-Kitaev-Preskill codes: A lattice perspective.*
J. Conrad, J. Eisert, **F. Arzani**
Quantum 6, 648 (2022). (arxiv:2109.14645)
- *Random coding for sharing bosonic quantum secrets.*
F. Arzani, G. Ferrini, F. Grosshans, D. Markham
Physical Review A 100 (2), 022303 (2019). (arXiv:1808.06870)
- *Bloch-Messiah reduction for twin beams of light.*
D. B. Horoshko, L. La Volpe, **F. Arzani**, N. Treps, C. Fabre, M. I. Kolobov
Physical Review A 100 (1), 013837(2019). (arXiv:1903.06578)
- *High-dimensional quantum encoding via photon-subtracted squeezed states.*
F. Arzani, A. Ferraro, V. Parigi
Physical Review A 99 (2), 022342 (2019). (arXiv:1811.09263)
- *Violating Bell inequalities with entangled optical frequency combs and multi-pixel homodyne detection.*
W. N. Plick, **F. Arzani**, N. Treps, E. Diamanti, D. Markham
Physical Review A 98 (6), 062101 (2018). (arXiv:1805.06059)
- *Reconfigurable optical implementation of quantum complex networks.*
J. Nokkala, **F. Arzani**, F. Galve, R. Zambrini, S. Maniscalco, J. Piilo, N. Treps, V. Parigi.
New Journal of Physics 20 (5), 053024 (2018). (arXiv:1708.08726)
- *Versatile engineering of multimode squeezed states by optimizing the pump spectral profile in spontaneous parametric down-conversion.*
F. Arzani, C. Fabre, N. Treps.
Physical Review A 97 (3), 033808 (2018). (arXiv:1709.10055)

- *Polynomial approximation of non-Gaussian unitaries by counting one photon at a time.*
F. Arzani, N. Treps, G. Ferrini
Physical Review A 95 (5), 052352 (2017). (arXiv:1703.06693)
- *Multimode entanglement in reconfigurable graph states using optical frequency combs.*
Y. Cai, J. Roslund, G. Ferrini, **F. Arzani**, X. Xu, C. Fabre, N. Treps.
Nature Communications 8, 15645 (2017). (arXiv:1605.02303)
- *A direct approach to Gaussian measurement based quantum computation.*
G. Ferrini, J. Roslund, **F. Arzani**, C. Fabre, N. Treps.
Physical Review A 94 (6), 062332 (2016). (arXiv:1605.03350)
- *Optimization of networks for measurement-based quantum computation.*
G. Ferrini, J. Roslund, **F. Arzani**, Y. Cai, C. Fabre, N. Treps.
Physical Review A 91 (3), 032314 (2015). (arXiv:1407.5318)

Other

- *Harmonizing continuous noise to build a modular photonic quantum computer.*
F. Arzani
Quantum Views 5, 51 (2021).
- *Measurement based quantum information with optical frequency combs.*
F. Arzani
PhD Thesis, Paris Sciences Lettres and École Normale Supérieure de Paris (2018)

Talks, conferences, workshops, schools

- 09/2022 **CQIQC IX**,
Contributed talk *Conference on quantum information and quantum control, Fields Institute, Toronto, Canada,*
“Gottesman-Kitaev-Preskill bosonic error correcting codes: a lattice perspective”
- 09/2021 **Xanadu**,
Invited talk *Xanadu Quantum Technologies, Toronto ON, Canada,*
“Gottesman-Kitaev-Preskill bosonic error correcting codes: a lattice perspective”
- 09/2021 **IPP**,
Invited talk *Télécom Paris - Institut Polytechnique de Paris, Palaiseau, France,*
“Continuous-variable quantum information, multi-mode quantum optics and bosonic error correcting codes ”
- 09/2021 **SAMOP21**,
Contributed talk *Virtual DPG-Meeting of the Atomic, Molecular, Plasma Physics and Quantum Optics Section (SAMOP),*
“Gottesman-Kitaev-Preskill bosonic error correcting codes: a lattice perspective”
- 08/2019 **CQIQC VIII**,
Contributed talk *Conference on quantum information and quantum control, Fields Institute, Toronto, Canada,*
“Random coding for sharing bosonic quantum secrets”
- 11/2018 **Q-Turn 2018**,
Contributed talk *Workshop on changing paradigms in quantum science, Universidade Federal de Santa Catarina, Florianópolis, Brazil,*
“Quantum secret sharing using squeezing and almost any passive interferometer”
- 11/2018 **JIQ 2018**,
Contributed talk *Journées d’Informatique Quantique, Laboratoire Lorrain de recherche en informatique et ses applications, Nancy, France,*
“Quantum secret sharing using squeezing and almost any passive interferometer”
- 09/2018 **QuTech 2018**,
Contributed talk *Quantum technology international conference, 1st edition, Kastler Brossel laboratory, Paris, France,*
“Versatile engineering of multimode squeezed states by optimizing the pump spectral profile in spontaneous parametric down-conversion”

- 09/2017 **Workshop on quantum science and technologies**,
 Contributed talk *International Center for Theoretical Physics, Trieste, Italy*,
 “Polynomial approximation of non-Gaussian unitaries by counting one photon at a time”
- 05/2017 **Photons beyond qubits 2017**,
 Invited talk *Palacký University, Olomouc, Czech Republic*,
 “Measurement-based quantum information protocols with optical frequency combs”
- 04/2017 **Quantum information and measurement 2017**,
 Contributed talk *4th edition, Université Pierre et Marie Curie, Paris, France*,
 “Shaping the Pump of a Synchronously Pumped Optical Parametric Oscillator for Continuous - Variable Quantum Information”
- 11/2016 **GDR Quantum Information 2016**,
 Poster *7th colloquium of the CNRS research network on Quantum information, foundations and applications, Télécom ParisTech, Paris, France*,
 “Shaping the Pump of a Synchronously Pumped Optical Parametric Oscillator for Continuous - Variable Quantum Information”
- 06/2016 **CEWQO 2016**,
 Poster *23rd central european workshop on quantum optics, Orthodox Academy of Crete, in Kolymbari, Crete, Greece*,
 “Quantum Computing with Optical Frequency Combs”
- 04/2015 **International School on Parametric Nonlinear Optics**,
 Attendance *Les Houches School of Physics, Les Houches, France*