# Francesco Arzani

Researcher in quantum information and quantum optics

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frarzani.github.io/

## Academic and professional experience

05/2021–current **Consultant**, *Xanadu Quantum Technologies – Toronto, Ontario, Canada (remote)*

09/2020–current **Post-doctoral researcher**, *Freie Universiät 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 Pedrix

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)

## Awards and fellowships

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

11/2021–03/2022 **Teaching assistant**, *Freie Universitat Berlin*,
Quantum information (Master's level)

11/2019 **Fête de la Science**, *Sorbonne Univérsité*,
Presentation of quantum information to high school students

09/2018–12/2018 **Teaching assistant and lab demonstrator (Vacataire)**, *Univérsité 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

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|---|---|
| Mother tongue | Italian |
| Fluent | English, French |
| Basic | German |

## Computer Skills

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

## Publications

### 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 quantunm 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 quantunm 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 rechèrche 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 Continous - 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 Continous - 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*