Francesco **Albarelli**, PhD

Quantum information theorist

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I am a postdoctoral researcher in quantum information theory, with a particular interest in multiparameter quantum estimation theory and metrology, continuously monitored quantum systems and nonclassicality of continuous variable quantum systems.

Experience

Research assistant, Faculty of Physics, University of Warsaw, Poland 2019–Present
Postdoc position (Polish: ***adiunkt badawczy***) in the theoretical quantum metrology group led by Rafał Demkowicz-Dobrzański. Main themes of research: noisy multiparameter quantum metrology and spatially correlated noise in quantum interferometry.

Research fellow, Dept. of Physics, University of Warwick, Coventry, United Kingdom 2018–2019
Postdoc position in the Quantum Information Science group led by Animesh Datta, funded by the Networked Quantum Information Technologies Hub (NQIT). Main themes of research: multiparameter quantum estimation theory and metrology.

Visiting reseach student, Dept. of Physics, University College London, UK 2018
Conducted research in collaboration with Alessio Serafini on quantum control for continuous variable systems.

Traineeship Erasmus+, Centre for Theoretical AMO Physics, Queen's University Belfast, UK 2017
Visited the Quantum Technology group to collaborate with Alessandro Ferraro on resource theories of nonclassicality and non-Gaussianity.

Teaching assistant, University of Milan, Italy 2015–2018
General physics, C++ programming and mathematics, see Teaching below.

Education

Philosophiae Doctor (Ph.D.), Dept. of Physics, University of Milan, Italy 2015–2018
Dissertation: Continuous measurements and nonclassicality as resources for quantum technologies.
Supervisor: Matteo G. A. Paris. External Referees: Alessio Serafini and Rajiah Simon.
International schools attended

- **Quantum Complex Systems Out of Equlibrium**, Lake Como School of Advanced Studies, Como, Italy, 29 Jul–3 Aug 2018
- **Quantum Machine Learning**, 28th Chris Engelbrecht Summer School, Drakensberg mountains, South Africa, 23 Jan–1 Feb 2017
- **Quantum Simulators**, International School of Physics "Enrico Fermi" Course 198, Varenna, Italy, 22–27 Jul 2016; admitted with scholarship

Master of Science (M.Sc.), Dept. of Physics, University of Bologna, Italy 2012–2015
Final grade: ***Summa cum laude***. Specialized curriculum in theoretical physics. Dissertation: Nonlinearity as a resource for nonclassicality. Supervisors: Matteo G. A. Paris and Cristian Degli Esposti Boschi.

Bachelor of Science (B.Sc.), Dept. of Physics, University of Bologna, Italy 2009–2012
Final grade: ***Summa cum laude***. General curriculum in physics. Dissertation: The role of entropy in Gibbs paradox (in Italian). Supervisors: Alessandro Pesci and Elisa Ercolessi.

High school diploma, Scientific Lyceum "Georges Lemaître", Rimini, Italy 2004–2009
State exam mark: ***100/100 cum laude***.

Teaching

Teaching assistant, General physics (in Italian) 2015–2018
Bachelor course in chemistry L-27, University of Milan (3 academic years)

Teaching assistant, C++ programming (in Italian) 2016–2018
Bachelor course in physics L-30, University of Milan (2 academic years)

Teaching assistant, Fundamentals of Mathematics (in Italian) 2015–2016
Bachelor course in chemistry L-27, University of Milan

Supervision

Giacomo Piscia, Master student in Physics, Università degli Studi di Milano, co-supervisor with M. G. Genoni and M. G. A Paris. Project: Multi-parameter quantum metrology with time-continuous measurements — 2021

Languages

Mother tongue **Italian**

Other languages[1]

	Understanding		Speaking		Writing
	Listening	Reading	Interaction	Production	
English[2]	C2 Fluent	C2 Fluent	C1 Fluent	C1 Fluent	C1 Fluent

[1] *Common European Framework of Reference for Languages (CEFR)*

[2] *IELTS - British Council, 12/07/2014 (Overall Score: 8.0/9.0)*

Personal interests

Music, Rationality, Science, Sustainability, Food, Books

Publications

Web of Science/Publons metrics

publications	total times cited	h-index	verified reviews
17	186	8	41

International peer-reviewed journals

[18] Experimental Quantum-Enhanced Response Function Estimation
Ilaria Gianani, Francesco Albarelli, Valeria Cimini, Marco Barbieri
Phys. Rev. A, accepted (2021), arXiv:2007.15564

[17] Noisy Quantum Metrology Enhanced by Continuous Nondemolition Measurement
Matteo A. C. Rossi, Francesco Albarelli, Dario Tamascelli, Marco G. Genoni
Phys. Rev. Lett. **125**, 200505 (2020), arXiv:2006.08974

[16] Quantum Semiparametric Estimation
Mankei Tsang, Francesco Albarelli, Animesh Datta
Phys. Rev. X **10**, 031023 (2020), arXiv:1906.09871

[15] Time-Local Optimal Control for Parameter Estimation in the Gaussian Regime
Alexander Predko, Francesco Albarelli, Alessio Serafini
Phys. Lett. A **384**, 126268 (2020), arXiv:2001.03551

[14] A Perspective on Multiparameter Quantum Metrology: From Theoretical Tools to Applications in Quantum Imaging
Francesco Albarelli, Marco Barbieri, Marco G. Genoni, Ilaria Gianani
Phys. Lett. A **384**, 126311 (2020), arXiv:1911.12067

[13] On the Discontinuity of the Quantum Fisher Information for Quantum Statistical Models with Parameter Dependent Rank
Luigi Seveso, Francesco Albarelli, Marco G. Genoni, Matteo G. A. Paris
J. Phys. A **53**, 02LT01 (2020), arXiv:1906.06185

[12] Characterizing Non-Deterministic Noiseless Linear Amplifiers at the Quantum Limit
Hamza Adnane, Francesco Albarelli, Abdelhakim Gharbi, Matteo G. A. Paris
J. Phys. A **52**, 495302 (2019), arXiv:1901.07480

[11] Evaluating the Holevo Cramér-Rao Bound for Multiparameter Quantum Metrology
Francesco Albarelli, Jamie F. Friel, Animesh Datta
Phys. Rev. Lett. **123**, 200503 (2019), arXiv:1906.05724

[10] Quantum State Engineering by Nondeterministic Noiseless Linear Amplification
Hamza Adnane, Matteo Bina, Francesco Albarelli, Abdelhakim Gharbi, Matteo G. A. Paris
Phys. Rev. A **99**, 063823 (2019), arXiv:1901.10509

[9] Quantum Frequency Estimation with Conditional States of Continuously Monitored Independent Dephasing Channels
Francesco Albarelli, Matteo A. C. Rossi, Marco G. Genoni
Int. J. Quantum Inf. **17**, 1941013 (2019), arXiv:1910.12549

[8] Locally Optimal Control of Continuous-Variable Entanglement
Francesco Albarelli, Uther Shackerley-Bennett, Alessio Serafini
Phys. Rev. A **98**, 062312 (2018), arXiv:1711.11400

[7] Restoring Heisenberg Scaling in Noisy Quantum Metrology by Monitoring the Environment
Francesco Albarelli, Matteo A. C. Rossi, Dario Tamascelli, Marco G. Genoni
Quantum **2**, 110 (2018), arXiv:1803.05891

[6] Resource Theory of Quantum Non-Gaussianity and Wigner Negativity
Francesco Albarelli, Marco G. Genoni, Matteo G. A. Paris, Alessandro Ferraro
Phys. Rev. A **98**, 052350 (2018), arXiv:1804.05763

[5] Ultimate Limits for Quantum Magnetometry via Time-Continuous Measurements
Francesco Albarelli, Matteo A. C. Rossi, Matteo G. A. Paris, Marco G. Genoni
New J. Phys. **19**, 123011 (2017), arXiv:1706.00485

[4] Generation of Coherence via Gaussian Measurements
Francesco Albarelli, Marco G. Genoni, Matteo G. A. Paris
Phys. Rev. A **96**, 012337 (2017), arXiv:1705.04997

[3] Quantum Backflow Effect and Nonclassicality
Francesco Albarelli, Tommaso Guaita, Matteo G. A. Paris
Int. J. Quantum Inf. **14**, 1650032 (2016), arXiv:1604.07141

[2] Enhanced Estimation of Loss in the Presence of Kerr Nonlinearity
Matteo A. C. Rossi, Francesco Albarelli, Matteo G. A. Paris
Phys. Rev. A **93**, 053805 (2016), arXiv:1602.07626

[1] Nonlinearity as a Resource for Nonclassicality in Anharmonic Systems
Francesco Albarelli, Alessandro Ferraro, Mauro Paternostro, Matteo G. A. Paris
Phys. Rev. A **93**, 032112 (2016), arXiv:1507.07840

Conference proceedings

[2] Continuous Measurements for Advanced Quantum Metrology
Francesco Albarelli, Matteo A. C. Rossi, Dario Tamascelli, Marco G. Genoni
Proceedings **12**, 47 (2019)

[1] The Role of Monitoring Time and Detectors Efficiencies in Time-Continuous Quantum Magnetometry
Francesco Albarelli, Matteo A. C. Rossi, Matteo G. A. Paris, Marco G. Genoni
Toward a Science Campus in Milan, (2018), Springer International Publishing

Preprints

[1] Attainability of the Holevo-Cramér-Rao Bound for Two-Qubit 3D Magnetometry
Jamie Friel, Pantita Palittapongarnpim, Francesco Albarelli, Animesh Datta
arXiv:2008.01502 (2020)

Presentations

Contributed talks

[4] Recent advances in multiparameter quantum estimation
4th AQM meeting, Milan, Italy, 20 Dec 2019

[3] Evaluating the Holevo Cramér-Rao bound for multi-parameter quantum metrology
IQIS 2019 (12th Italian Quantum Information Science Conference), Milan, Italy, 9–12 Sep 2019

[2] Restoring Heisenberg scaling in noisy quantum metrology by monitoring the environment
Quantum Roundabout 2018, Nottingham, United Kingdom, 11–13 Jul 2018

[1] Ultimate limits for quantum magnetometry via time-continuous measurements
YQIS 2017 (3rd International Conference for Young Quantum Information Scientists), Erlangen, Germany, 3–6 Oct 2017

Posters

[10] Noisy Quantum Metrology Enhanced by Continuous Nondemolition Measurement
CTP Quantum Information Days 2020(+1), Warsaw, 22–24 Feb 2021

[9] Evaluating and upper bounding the Holevo Cramér-Rao bound
QQQ Workshop (Quantum open systems, Quantum thermodynamics, Quantum probability), Milan, Italy, 18–21 Feb 2020)

[8] The Holevo Cramér-Rao bound for multi-parameter quantum metrology
CEWQO2019 (26th Central European Workshop on Quantum Optics), Paderborn, Germany, 3–7 June, 2019

[7] The Holevo Cramér-Rao bound for multi-parameter quantum metrology
Quantum Measurement: Fundamentals, Twists, and Applications, Trieste, Italy, 29 Apr–4 May 2019

[6] Locally optimal control of continuous variable entanglement
IQIS 2018 (11th Italian Quantum Information Science Conference), Catania, Italy, 17–20 Sep 2018

[5] Restoring Heisenberg scaling in noisy quantum metrology by monitoring the environment
PRACQSYS 2018 (Principles and Applications of Control in Quantum Systems), Paris, France, 2–6 Jul 2018)

[4] Generation of coherence via Gaussian measurements
IQIS 2017 (10th Italian Quantum Information Science Conference), Florence, Italy, 12-15 September 2017

[3] Nonlinearity as a resource for quantum technologies
636 WE-Heraeus-Seminar: Quantum-Limited Metrology and Sensing, Bad Honnef, Germany, 6–9 Feb 2017)

[2] Nonlinearity as a resource for quantum technologies
IQIS 2016 (9th Italian Quantum Information Science Conference), Rome, Italy, 20–23 Sep 2016

[1] Nonlinearity as a resource for quantum technologies
Quantum Roundabout 2016, Nottingham, United Kingdom, 6–8 Jul 2016