



**AL MAGNIFICO RETTORE
DELL'UNIVERSITA' DEGLI STUDI DI MILANO**

COD. ID: 6077

Il sottoscritto chiede di essere ammesso a partecipare alla selezione pubblica, per titoli ed esami, per il conferimento di un assegno di ricerca presso il Dipartimento di Fisica

Responsabile scientifico: Enrico Prati

Antonio Mandarino

Curriculum Vitae

Personal Details

Name and Surname: Antonio Mandarino

Position

- 02/2019 – Present **Adiunkt**, *International Center for Theory of Quantum Technologies - Gdańsk University*, Gdańsk, Poland.
- 12/2017 – 12/2018 **Ingénieur d'études**, *Université Bourgogne-Franche Comté - Institut UTINAM*, Besançon, France.
- 10/2016 – 11/2017 **Adiunkt**, *Center for Theoretical Physics - Polish Academy of Science*, Warsaw, Poland.
- 23 June 2016 – 06 July 2016 **External member of the examination board for the high-school exit exam**, *Istituto Tecnico Industriale Statale Bernocchi*, Legnano (MI), Italy.
- 09 January 2016 – 30 June 2016 **High School teacher Mathematics and Physics classes**, *Liceo Scientifico Vittorio Veneto*, Milano.
- 11/2012 – 01/2016 **PhD student in Physics**, *Università degli Studi di Milano*, Italy.

Education

- 20 January 2016 **PhD in Physics**, *Università degli Studi di Milano*.
- 08 May 2012 **Master degree in Physics**, *Università della Calabria*, 110/110 cum laude.
- 30 September 2008 **Bachelor degree in Physics**, *Università della Calabria*, 110/110 cum laude.
- 12 July 2005 **Maturità Scientifica**, (*High school diploma in scientific subjects*) *Liceo scientifico Pitagora, Rende (CS)*, 100/100.

Scientific Visit

- 01 October 2018 – 06 October 2018 **Visiting Researcher**, at Center for Theoretical Physics - Polish Academy of Science, Prof. K. Życzkowski.
- 10 April 2015 – 10 June 2015 **Visiting Student**, at IFISC - Instituto de Física Interdisciplinar y Sistemas Complejos- Universitat de les Illes Balears (UIB), Palma de Mallorca (Spain), Dr. R. Zambrini.
- 27 April 2014 – 30 October 2014 **Visiting Student**, at IFISC - Instituto de Física Interdisciplinar y Sistemas Complejos- Universitat de les Illes Balears (UIB), Palma de Mallorca (Spain), Dr. R. Zambrini.

Scholarship and Awards

- 2023 **Individual Award of the Rector of the University of Gdansk**, *Motivation: for a series of publications concerning quantum information theory and quantum technology.*
- 2022 **Erasmus+ Staff Mobility at Physics Department, University of Malta, Msida, Malta - 1 week**, *Contract no. 2021-1-PL01-KA131-HED-000056964.*
- 2022 **Erasmus+ Staff Mobility at Computer Science Department, University of Verona, Verona, Italy - 1 week**, *Contract no. 2021-1-PL01-KA103-HED-000009281.*
- 2021 **Erasmus+ Staff Mobility at Computer Science Department, University of Verona, Verona, Italy - 1 week**, *Contract no. 2020-1-PL01-KA103-078531.*

- 2021 **Visiting Professorship**, *Computer Science Department, University of Verona, Verona, Italy.*
- 2020 **HPC-Europa3 Transnational Access programme - HPC-EUROPA3 (INFRAIA-2016-1-730897)**, *Contract no. HPC1779ICJ, CSC-Finland.*
- 2017 **Scholarship to participate to the thematic trimester on Measurement and Control of Quantum Systems: Theory and Experiments**, *Institut Henri Poincaré, Paris, France.*
- 2014 **Erasmus+ Student Placement LLP**, *IFISC - Instituto de Física Interdisciplinar y Sistemas Complejos- Universitat de les Illes Balears (UIB), Palma de Mallorca (Spain), 6 months.*
- 2013 **Winner of the Davide Colosimo Prize**, *Graduate School of Physics, Astrophysics and Applied Physics - University of Milan - Milan (MI) Italy.*
- 2012-2015 **Three years scholarship to attend the PhD school In Physics**, *University of Milan - Milan (MI) Italy.*
- 2009 **Winner of an individual voucher**, *European Union and Regione Calabria in the contest of POR CALABRIA 2000/2006 MISURA 3.6 PREVENZIONE DELLA DISPERSIONE SCOLASTICA E FORMATIVA Azione 3.6.f Programmi di formazione per l'apprendimento delle lingue straniere MISURA 3.7 FORMAZIONE SUPERIORE E UNIVERSITARIA Azione 3.7 b Incentivi alle persone .*
- 2008 **Winner of a prize as best university student**, *European Union and Regione Calabria in the contest of POR CALABRIA 2000/2006 Misura 3.7 Alta Formazione Azione 3.7.B Incentivi alle persone POR FSE CALABRIA 2007/2013 ASSE IV Capitale Umano.*

Grants

- 2023 **UGrants-start 533-0A00-GS09-23**, *University of Gdansk Starting Grant for young scientists, ~4k €, Principal Investigator.*
- 2022 **HPC1799ICJ**, *HPC-Europa3 Transnational Access programme, European Commission H2020 - Research and Innovation programme (under grant agreement No 730897) , CSC - Finland, ~5k €, Principal Investigator.*
- 2020 **Miniatura 2021 - Molecular nanomagnets for quantum technologies applications**, *Narodowe Centrum Nauki, ~11k €, Principal Investigator.*
- 2017 **Mobility grant for young scientist**, *Higher education department of the Conseil Régional Burgundy-Franche Comté, 48k €, Principal Investigator.*
- 2017 **Young Scientist Grant**, *Center for Theoretical Physics - Polish Academy of Science (Poland), Internal Competition, ~3k €.*

Participation in Projects

- 2022-2023 **Quantum computing behind and beyond its physical principles**, *PIA2022_CATB_DIPIERRO*, *University of Verona, Principal Investigator–Visiting Professorship.*
- 2021-2022 **Quantum computing behind and beyond its physical principles**, *INTAT20DIPIERRO*, *University of Verona, Principal Investigator–Visiting Professorship.*
- 2017-2018 **Quantum collective phenomena in controlled open quantum systems**, *2017 Y-06400*, *Region Burgundy Franche-Comté, Principal Investigator–Postdoc.*
- 2016-2017 **Uncertainty relations and quantum entanglement**, *DEC-2015/18/A/ST2/00274*, *Polish National Science Centre, Collaborator–Postdoc.*
- 2014-2015 **Quantum Probes for Complex Systems**, *H2020 Project QuProCS (Grant Agreement 641277)*, *European Union, Collaborator–PhD student.*
- 2012-2014 **Light Correlations for High-precision Innovative Sensing**, *FIRB-LiCHIS-RBFR10YQ3H*, *Italian Ministry of Education, Universities and Research, Collaborator–PhD student.*

Publications

Preprints

5. M. Hoffmann *et al.*,
Network medicine-based epistasis detection in complex diseases: ready for quantum computing
medRxiv:2023.11.07.23298205;
4. F.P. Barone, O. Kiss, M. Grossi, S. Vallecorsa, A. Mandarino,
Counterdiabatic optimized driving in quantum phase sensitive models
arXiv:2311.04282 ;
3. G. Scala, A. Mandarino
Insights into Quantum Contextuality and Bell Nonclassicality: a Study on Random Pure Two-Qubit Systems
arXiv:2310.09047;
2. P.J. Cavalcanti, A. Mandarino, G. Scala, C. Lupo
Information theoretical perspective on the method of Entanglement Witnesses
arXiv:2308.07744;
1. M. Winczewski, A. Mandarino, M. Horodecki, R. Alicki
Bypassing the Intermediate Times Dilemma for Open Quantum System
arXiv:2106.05776v1;

Publications on peer review journal

Underlined contribution means corresponding authorship

23. M. Incudini, M. Grossi, A. Ceschini, A. Mandarino, M. Panella, S. Vallecorsa, D. Windridge
Resource saving via ensemble techniques for quantum neural networks
Quantum Mach. Intell. **5**, 39 (2023);
22. M. Incudini, M. Grossi, A. Mandarino, S. Vallecorsa, A. Di Pierro, D. Windridge
The Quantum Path Kernel: a Generalized Neural Tangent Kernel for Deep Quantum Machine Learning
IEEE Trans. Quantum Eng. **4**, 3101616 (2023);
21. S. Monaco, O. Kiss, A. Mandarino, S. Vallecorsa, M. Grossi,
Quantum phase detection generalisation from marginal quantum neural network models
Phys. Rev. B **107**, L081105 (2023);
20. M. Grossi, O. Kiss, F. De Luca, C. Zollo, I. Gremese, A. Mandarino,
Finite-size criticality in fully connected spin models on superconducting quantum hardware
Phys. Rev. E **107**, 024113 (2023);
19. N. Gigena, G. Scala, A. Mandarino
Revisited aspects of the local set in CHSH Bell scenario
Int. J. Quantum Inf. **21**, 2340005 (2023);
18. A. Mandarino, G. Scala
On the Fidelity Robustness of CHSH-Bell Inequality via Filtered Random States
Entropy **25**(1), 94 (2023);
17. K. Schlichtholz, A. Mandarino, M. Żukowski
Bosonic fields in states with undefined particle numbers possess detectable non-contextuality features, plus more
New J. Phys. **24**, 103003 (2022);
16. T. Das, M. Karczewski, A. Mandarino, M. Markiewicz, M. Żukowski
Optimal interferometry for Bell-nonclassicality induced by a vacuum–one-photon qubits
Phys. Rev. Applied **18**, 034074 (2022);

15. M. Karczewski, G. Scala, A. Mandarino, A.B. Sainz, M. Żukowski
Avenues to generalising Bell inequalities
J. Phys. A: Math. Theor. **55**, 384011 (2022);
14. M. Incudini, R. Mengoni, F. Tarocco, A. Di Pierro, and A. Mandarino
Computing graph edit distance on quantum devices
Quantum Mach. Intell. **4**, 24 (2022);
13. A. Mandarino
Quantum Thermal Amplifiers with Engineered Dissipation
Entropy **24**(8), 1031 (2022);
12. T. Das, M. Karczewski, A. Mandarino, M. Markiewicz, B. Woloncewicz, M. Żukowski
Remarks about Bell-nonclassicality of a single photon
Phys. Lett. A **435**, 128031 (2022);
11. T. Das, M. Karczewski, A. Mandarino, M. Markiewicz, B. Woloncewicz, M. Żukowski
Comment on 'Single particle nonlocality with completely independent reference states'
New J. Phys. **24**, 038001 (2022);
10. T. Das, M. Karczewski, A. Mandarino, M. Markiewicz, B. Woloncewicz, M. Żukowski
Wave-particle complementarity: detecting violation of local realism with photon-number resolving weak-field homodyne measurements
New J. Phys. **24**, 033017 (2022);
9. A. Mandarino, M. Domínguez Gómez, K. Joulain, and B. Bellomo
Thermal transistor effect in quantum systems
Phys. Rev. Applied **16**, 034026 (2021);
8. T. Das, M. Karczewski, A. Mandarino, M. Markiewicz, B. Woloncewicz, M. Żukowski
Can single photon excitation of two spatially separate modes lead to a violation of Bell inequality in optical interferometric experiments?
New J. Phys. **23**, 073042 (2021);
7. A. Mandarino, T. Linowski, and K. Życzkowski
Bipartite unitary gates and billiard dynamics in the Weyl chamber
Phys. Rev. A **98**, 012335 (2018);
6. F. Galve, A. Mandarino, M.G.A. Paris, C. Benedetti and R. Zambrini
Microscopic description for the emergence of collective dissipation in extended quantum systems
Sci. Rep., **7**, 42050 (2017);
5. C. Benedetti, F. Galve, A. Mandarino, M.G.A. Paris, and R. Zambrini
Minimal model for spontaneous quantum synchronization
Phys. Rev. A, **94**, 052118 (2016);
4. A. Mandarino, M. Bina, C. Porto, S. Cialdi, S. Olivares, and M.G.A. Paris,
Assessing the significance of fidelity as a figure of merit in quantum state reconstruction of discrete and continuous variable systems
Phys. Rev. A, **93**, 062118 (2016)
Phys. Rev. A kaleidoscope selection (June 2016);
3. G. Salvatori , A. Mandarino, and M.G.A. Paris,
Quantum metrology in Lipkin-Meshkov-Glick critical systems
Phys. Rev. A **90**, 022111 (2014);
2. A. Mandarino, M. Bina, S. Olivares, and M.G.A. Paris,
About the use of fidelity in CV systems
Int. J. Quantum Inf. **12**, 1461015 (2014);
1. M. Bina, A. Mandarino, S. Olivares, and M.G.A. Paris,
Drawbacks of the use of fidelity to assess quantum resources

Phys. Rev. A **89**, 012305 (2014)
Phys. Rev. A kaleidoscope selection (January 2014).

Thesis

- Phd Quantum probing and characterization techniques for systems of interest in quantum information processing (Supervisor Prof. M. G. A. Paris)
DOI:10.13130/mandarino-antonio_phd2016-01-20
- Master Degree Quantum correlations in the XX spin chain in external field (Supervisor Prof. F. Plastina)
- Bachelor Degree Bell's inequalities and mismatches in joint quantum measurements (Supervisor Prof F. Piperno)

Invited Seminars

- 05 May 2023 **Harnessing the Bell-nonclassicality of a single photon state**, *University of Calabria*, Department of Physics, Cosenza - Italy.
- 05 May 2023 **Bell-nonclassicality with a single photon state**, *Columbia University*, Department of Physics, New York - USA.
- 15 December 2022 **Optimal interferometry and Bell-nonclassicality with a single photon state.**, *University of Malta*, Department of Physics, Msida - Malta.
- 30 March 2022 **Computing Graph Edit distance with quantum devices**, *VTT*, Finland, Helsinki.
- 18 January 2019 **Thermal transistor effect in quantum systems**, *University of Gdańsk*, Institute of Theoretical Physics and Astrophysics, Gdańsk.
- 22 November 2018 **Quantum thermal analogies of electronic devices**, *University of Franche-Comté*, Institut UTINAM, Besançon.
- 19 November 2018 **Thermal transistor effect in quantum systems**, *Institute of Physics, University of Freiburg*, Quantum Optics and Statistics Group, Freiburg.
- 01 October 2018 **Thermal transistor effect in quantum systems**, *Marian Smoluchowski Institute of Physics, Jagiellonian University*, Chaos and Quantum Information Seminar, Cracow.
- 08 August 2017 **Microscopic models for the emergence of collective phenomena in extended quantum systems**, *Department of Physics, Waseda University*, Kazuya Yuasa Group, Tokyo.
- 25 July 2017 **Bipartite unitary gates and billiard dynamics in the Weyl chamber**, *Department of Physics, University of Calabria*, Quantum and Condensed Matter Physics Group, Cosenza.
- 18 July 2017 **Bipartite unitary gates and billiard dynamics in the Weyl chamber**, *Department of Physics, University of Milan*, Applied Quantum Mechanics group, Milan.
- 12 April 2017 **Long time behavior of non local quantum gates**, *Marian Smoluchowski Institute of Physics, Jagiellonian University*, Chaos and Quantum Information Seminar, Cracow.
- 12 April 2017 **Quantum thermometry with critical spin systems**, *Center for Theoretical Physics - Polish Academy of Science*, BEC-Seminar, Warsaw.
- 23 November 2016 **Minimal model for quantum spontaneous synchronization**, *Center for Theoretical Physics - Polish Academy of Science*, Warsaw.
- 22 July 2016 **Microscopic description for the emergence of collective dissipation in extended quantum systems**, *LENS - Università degli studi di Firenze*.

Conferences and workshop

- 2019 Quantum Resources and Their Application, Sopot (Poland) 23-25 May 2019 - Invited Participation
- 2017 Within and beyond Quantum Mechanics, Sopot (Poland) 25-27 May 2017 - Invited Participation

2017 8th Workshop on Quantum Chaos and Localization Phenomena, Warsaw (Poland) 19-21 May 2017

Talks

2023 *Detection of quantum phase transitions with quantum machine learning techniques.*
QTML 2023 - 7th Quantum Techniques in Machine Learning Conference, CERN-Geneva Switzerland, 19 - 24 November 2023

2022 *Bell-nonclassicality with a single photon state.*
CEWQO 2023 - 27th Central European Workshop on Quantum Optics, Milan Italy, 03 - 07 July 2023

2022 *Optimal interferometry and Bell-nonclassicality with a single photon state.*
IQIS 2022 - 14th Italian Quantum Information Science Conference, Palermo Italy, 12 - 16 September 2022

2022 *Optimal interferometry and Bell-nonclassicality with a single photon state.*
15th Fifteenth Biennial Quantum Structure 2022 Conference, Tropea Italy, 26 June - 02 July 2022

2019 *Quantum thermal analogies of electronic devices.*
IQIS 2019 - 12th Italian Quantum Information Science Conference, Milan Italy, 09 - 12 September 2019

2018 *Thermal transistor effect in quantum systems.*
104^o Italian Physical Society Congress, Rende (Italy) 17 - 21 September 2018

2017 *Geometric theory of bipartite quantum gates. Results and open problems.*
3rd AQMeeting, Varazze (Italy) 25 - 27 September 2017 (Invited talk)

2017 *Long time behavior of non local quantum gates*
49th Symposium on Mathematical Physics, Torun (Poland) 17 - 18 June 2017 (Invited talk)

2015 *Probing temperature with critical spin systems*
NMQD15 - Non Markovian Quantum Dynamics Workshop, Cortona (Italy) 24 - 28 August 2015 (Invited talk)

2015 *Some remarks when trusting someone else fidelity*
1st AQMeeting, Modena (Italy) 23 - 25 June 2015 (Invited talk)

Poster contribution

2019 *Quantum thermal analogies of electronic devices*
ECMM 2019 - 7th European Conference on Molecular Magnetism, Florence, Italy, 1 - 18 September 2019

2017 *Long time behavior of nonlocal quantum gates*
657. WE-Heraeus-Seminar: Quantum Correlations in Space and Time, Bad Honnef, Germany, Dec. 2017;

2017 *Long time behavior of nonlocal quantum gates*
2nd Arctic School on Open Quantum Systems, Kevo Finland, Sept. 2017;

2015 *Some remarks when assessing quantum features with fidelity*
IQIS 2015 - 8th Italian Quantum Information Science Conference, Monopoli Italy, Sept. 2015;

2015 *Quantum metrology in Lipkin-Meshkov-Glick critical systems*
2nd Quantum Thermodynamics Conference, Mallorca Spain, 19-24 April 2015

2013 *About the use of fidelity to assess quantum resources*
IQIS 2013 - 6th Italian Quantum Information Science Conference, Como Italy, Sept. 2013

Schools

- 2019 Summer School on Quantum Programming Languages Design and Implementation, University of Verona University, 23 - 28 September 2019, Verona, Italy;
- 2017 2nd Arctic School on Open Quantum Systems, Turku University, 10-15 September 2017, Kevo Station, Finland;
- 2013 Frontiers of Quantum Physics and Quantum Communication, ICFO (Institute of Photonic Sciences), July 2009, Barcelona, Spain;
- 2013 QSNOW2013 - Winter School in Quantum Communications, February 2013, Astrophysical Observatory of Asiago, Asiago (Italy);
- 2009 QUROPE09 International School on Quantum Information and Many-Body Systems - Scuola Normale Superiore di Pisa, May 2009, Cortona (Italy).

Conference Organization

- 2023 Member of the program committee of Quantum Techniques in Machine Learning, 19 - 24 November 2023, CERN (Geneve), Switzerland;
- 2022 Member of the program committee of Quantum Techniques in Machine Learning, 07 - 12 November 2022, Napoli, Italy.

Teaching activity

Selection committee

- 13 May 2019 Selection of PhD students - ICTQT, University of Gdansk
- 20 May 2019 Selection of master students- ICTQT, University of Gdansk
- 05 October 2023 Chairman of the commission of the final exam of the master in Quantum Information Technology, University of Gdansk

Academic Courses

- 2022/23 Quantum Optics - Quantum Information Technology master program - University of Gdansk - Gdansk Poland.
- 2021/22 Introduction to Quantum Computing - Course in Digital Specialist - Higher Technical Institutes (ITS) LAST - Verona (VR) Italy.
- 2021/22 Quantum Information Theory - Phd School in Computer Science - Università di Verona - Verona (VR) Italy.
- 2015/16 Mathematics preparatory course for the degree in Biological Sciences - Università degli studi di Milano - Milan (MI) Italy.

Teaching assistant

- 2014/15 General Physics courses (Physics and Physics Laboratory) degree in Chemistry - Università degli studi di Milano - Milan (MI) Italy;
- 2013/14 General Physics courses (Physics and Physics Laboratory) degree in Chemistry - Università degli studi di Milano - Milan (MI) Italy;
- 2012/13 General Physics courses (Physics and Physics Laboratory) degree in Biological Sciences - Università degli studi di Milano - Milan - Italy;
- 2012 - 2016 Designation as *Cultore della Materia* in Physics - Università degli studi di Milano - Milan (MI) Italy.

Tutoring

- 2011/12 Tutor for General Physics courses Faculty of Mathematical, Physical and Natural Sciences - Università della Calabria - Rende (CS) Italy;

- 2009/10 Tutor for General Physics courses Faculty of Mathematical, Physical and Natural Sciences - Università della Calabria - Rende (CS) Italy;
- 2008/09 Tutor for General Physics courses Faculty of Mathematical, Physical and Natural Sciences - Università della Calabria - Rende (CS) Italy.

Thesis advisor

- 2022 Fabio Tarocco, *A Quantum Phase Interference approach to the Glued Trees problem* - Master degree in Computer Science - Università di Verona
- 2013 Giulio Salvatori, *Quantum estimation for spin systems at criticality*. - Bachelor degree in Physics - Università degli studi di Milano

Internship Supervision

- 2023 Michał Wójcik, *Quantum computing for many-body nuclear physics* - Master degree program in Physics - University of Warsaw

Scientific Dissemination

Public Conference in High Schools

- March 2016 *Black Holes and detection - How too see two spinning black holes without light*, Liceo Scientifico "Vittorio Veneto" (Milano)

Popular Science Books

- 2016 Scientific Referee for the book series *Scoprire la scienza (Discovering science)*, Hachette Book Group-Italy
- 2016 Translation from Spanish to Italian of the book **Entropia. La regina del disordine** Marcos Jaén Sánchez, Hachette Book Group-Italy
- 2016 Translation from Spanish to Italian of the book **La guerra delle correnti. La rivoluzione dell'elettricità** Enrique F. Borja, Hachette Book Group-Italy
- 2016 Translation from Spanish to Italian of the book **La teoria del caos e della complessità. Il mondo è un caleidoscopio** Sergio de Régules, Hachette Book Group-Italy
- 2018 - 2020 Translation from Spanish to Italian of the book series **Atlante del Cosmo – 31 books**, National Geographic-Italy

Other Information

Membership

- 2015 - 2019 COST MP1209 Thermodynamics in the Quantum Regime Network;
- 2008 - now European Physical Society;
- 2008 - now Italian Physical Society.

Referee activity

- Regular Article Physical Review Letters, PRX Quantum, Physical Review A, Quantum, New Journal of Physics, SciPost Physics, Communication Physics (Nature group), Scientific Reports (Nature group), Physics Letters A, Quantum Information Processing, Quantum Machine Intelligence, PLOS ONE, Quantum Information and Communication, International Journal of Theoretical Physics, The European Physical Journal D.

- Research Project Spanish Ministry of Universities

IT skills

- Operating system Linux, Mac OS X, Windows
- Programming language Mathematica, Matlab, C++, Python, Qiskit

Languages

Italian Native speaker
English C2 of the Common European Framework
Spanish B2 of the Common European Framework
French B1 of the Common European Framework
Polish A2 of the Common European Framework



UNIVERSITÀ DEGLI STUDI DI MILANO

Le dichiarazioni rese nel presente curriculum sono da ritenersi rilasciate ai sensi degli artt. 46 e 47 del DPR n. 445/2000.

Il presente curriculum, non contiene dati sensibili e dati giudiziari di cui all'art. 4, comma 1, lettere d) ed e) del D.Lgs. 30.6.2003 n. 196.

Luogo e data: Gdansk, 10/12/2023