Andrea Di Biagio

Personal Details

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Research

2022–present **Postdoctoral Researcher**, Institute for Quantum Optics and Quantum Information (IQOQI) Vienna, Austria.
- working in Dr. Marios Christodoulou's Quantum Information Structure of Spacetime group
- research focus: foundations of quantum mechanics, low-energy quantum gravity, quantum geometry

2018–2022 **PhD in Theoretical Physics**, Sapienza University of Rome, Italy.
- supervisors: Prof. Carlo Rovelli and Prof. Giovanni Montani
- thesis title: 'What can low energy quantum systems teach us about space and time?'
- graduated with honours and special mention in the university-wide thesis prize

Education

2014–2016 **MSc in Applied Mathematics**, Imperial College London, United Kingdom.
- thesis: 'Asymptotic self-similarity in the Mandelbrot set'
- thesis Supervisor: Dr. Trevor Clark
- graduated with distinction

2009–2013 **MSci in Physics with Theoretical Physics**, Imperial College London, United Kingdom.
- thesis: 'Spacetime from causal structure'
- thesis supervisor: Prof. Fay Dowker
- graduated with first class honours
- prizes for academic excellence: Ken Allen Prize (2013), Gloucester Research Ltd Prize (2011), Dillon prize (2009), and Wilkins prize (2009)

1997–2009 **Bacalauréat Général Scientifique**, Lycée Chateaubriand de Rome, Italy.
- graduated with honours

Publications and preprints

2025-08 E. Broukal, ADB, E. Bianchi, M. Christodoulou, *Observables are glocal*, arXiv:2508.02346.

2024-11 G. Higgins, ADB, M. Christodoulou, *Truly relativistic gravity mediated entanglement protocol using superpositions of rotational energies*, Physical Review D **110**, L101901, arXiv:2403.02062.

2024-10 ADB, C. Rovelli, *On the Time Orientation of Probabilistic Theories*, Philosophy of Physics **2**, 1, 16, arXiv:2403.01062.

2024-09 Y. Yīng, M. Maciel Ansanelli, ADB, E. Wolfe, E. G. Cavalcanti, *Relating Wigner's Friend scenarios to Nonclassical Causal Compatibility, Monogamy Relations, and Fine Tuning*, Quantum **8**, 1485, arXiv:2309.12987.

2024-09 O. Bengyat, ADB, M. Aspelmeyer, M. Christodoulou, *Gravity Mediated Entanglement between Oscillators as Quantum Superposition of Geometries*, Physical Review D **110**, 056046, arXiv:2309.16312.

2024-05 E. Polino, B. Polacchi, D. Poderini, I. Agresti, G. Carvacho, F. Sciarrino, ADB, C. Rovelli, M. Christodoulou, *Photonic Implementation of Quantum Gravity Simulator*, on the cover of Advanced Photonics Nexus **3**, 3, 036011, arXiv:2207.01680.

2024-01 ADB, *Diagrams and GPTs for Quantum Gravity*, Quantum Views **8**, 78.

2023-11 E. G. Cavalcanti, ADB, C. Rovelli, *On the consistency of relative facts*, European Journal for Philosophy of Science **13**, 55, arXiv:2305.07343.

2023-05 ADB, R. Howl, Č. Brukner, C. Rovelli, M. Christodoulou, *Circuit locality from relativistic locality in scalar field mediated entanglement*, arXiv:2305.05645.

2023-03 M. Christodoulou, ADB, M. Aspelmeyer, Č. Brukner, C. Rovelli, R. Howl, *Locally mediated entanglement through gravity from first principles*, Physical Review Letters **130** 100202, arXiv:2202.03368.

2022-10 M. Christodoulou, ADB, P. Martin-Dussaud, *An experiment to test the discreteness of time*, Quantum **6**, 826, arXiv:2007.08431.

2022-07 M. Christodoulou, ADB, R. Howl, C. Rovelli, *Gravity entanglement, quantum reference systems, degrees of freedom*, Classical and Quantum Gravity **40**, 047001, arXiv:2207.03138.

2021-10 ADB, C. Rovelli, *Relational Quantum Mechanics is about Facts, not States: A reply to Pienaar and Brukner*, Foundations of Physics **52**, 62, arXiv:2110.03610.

2021-08 ADB, P. Donà, C. Rovelli, *The arrow of time in operational formulations of quantum theory*, Quantum **5**, 520, arXiv:2010.05734.

2021-02 ADB, C. Rovelli, *Stable Facts, Relative Facts*, Foundations of Physics **51**, 30, arXiv:2006.15543.

Talks

2025-07 *A tale of two localities*, invited talk at A look at the interface between gravity and quantum theory 2025

2025-06 *Bell, Wigner, causal reasoning, and interpretations*, QISS Virtual Seminar (online)

2025-04 *Permutation invariance and the quantum geometry exclusion principle*, International Loop Quantum Gravity Seminar (online)

2023-11 *When does relativistic locality imply subsystem locality?*, invited talk at RQI Circuit Vienna, IQOQI Vienna

2023-10 *Relative Facts, Relational Quantum Mechanics*, invited seminar at Atelier du LKB, Laboratoire Kastler Brossel, Paris

2023-09 *Is locality from the spectrum physically relevant?*, contributed talk at Kefalonia Foundations 2023

2022-12 *Integrated Information Theory and Wigner's Friend*, invited panel talk at Wigner's Friends: Theory Workshop, San Francisco

2022-09 *Assessing Ted Jacobson's work: Entanglement equilibrium and the Einstein field equations*, contributed talk at Kefalonia Foundations 2022

2022-06 *Relative Facts, Relational Quantum Mechanics*, invited lightning talk at QISS 2022, London Ontario

2021-06 *The arrow of time in operational formulations of quantum theory*, contributed talk at Time in Quantum Theory Workshop 2021, ETH, Zürich

2021-03 *What is the place of agents in physics?*, QISS Impressionistic Seminar (online)

2020-12 *Can we think timelessly about causation?*, invited seminar at Perimeter Institute Quantum Foundations (online)

2020-12 *Can we think timelessly about causation?*, invited seminar at the OIST Qubits and Spacetime Unit (online)

Poster presentations

2025-06 *Causal Models Cannot Explain QM Correlations in Extended Wigner's Friend Scenarios*, Helgoland 2025

2025-04 *Causal Models Cannot Explain QM Correlations in Extended Wigner's Friend Scenarios*, QISS 2025 Conference, University of Vienna

2024-09 *Causal Models Cannot Explain QM Correlations in Extended Wigner's Friend Scenarios*, Vienna Quantum Foundations, University of Vienna

2024-09 *Circuit Locality from Relativistic Locality in Scalar Field Mediated Entanglement*, Causalworlds, Perimeter Institute

Teaching

2023 *A GPT no-go theorem for the classicality of the gravitational field: The theoretical minimum*, lecture for graduate students at the University of Vienna

2021 *Low-energy quantum gravity experiments* invited lecture at the LQG Summer school 2021

2021 Teaching assistant for the multivariable calculus course in the Civil and Industrial Engineering Department at Sapienza University. Prepared 11 problem sets and solutions, as well as a mock exam for the course, and explained the solutions in front of the class.

Outreach

2023-current Keeping up a blog at www.patternsthatabide.xyz

2025 *Discovering physics*, a practical activities class for kindergarten and first and second primary school children on the equivalence principle and the thermodynamical arrow of time

2024 *Quantum observers are crazier than you thought* and *This quantum theorem is dividing physicists*, two podcast episodes on Maria Violaris' Quantum Channel Podcast.

2020 *Why nobody understands quantum physics?*, outreach talk at Yoga with Anysa

Community activities

2025 **Inaugural Workshop on Emergent Geometries**, Organiser.
Funding application and design for workshop for 30 researchers from various fields interested in the emergence of spacetime from non-geometrical structures, to be held at NORDITA.

2025 **Stromboli Summer Research Intensive workshop**, Organiser.
A self-directed, collaborative, research intensive for 12 early-career researchers on the volcano island of Stromboli

2025 **Basic Research Community for Physics**, Vice-chair and board member.
The BRCP is an international association focused on stimulating fundamental debates in science, promoting open and non-dogmatic inquiry, and fostering a cooperative research environment.

2022-2023 **QISS Virtual Seminars**, Organiser and host.
monthly seminar on various topics in gravity, quantum information theory, and foundations of quantum mechanics

2022-2023 **QISS 2023 Research School**, Organiser.
A school for about 40 PhD students with morning lectures by high–profile experts and self-organised afternoon activities.

2022 **QISS 2022 conference**, Organiser.

2021-current Active reviewer for various journals, mostly Quantum and Foundations of Physics, but also Annals of Physics, British Journal for the Philosophy of Science, Annals of Physics

Awards and fellowships

2025 **Gravity Theory Trust**, Grant to organise a workshop on the emergence of geometries, USD 18400.

2023 **Blaumann Foundation Fellowship**, Research grant and appointment as Fellow of the Blaumann Foundation, EUR 2000.
Research project: EmerGE, a multidisciplinary approach to emergent spacetime

2021 **Perimeter Institute Postdoctoral Fellowship**.
Awarded, but forsaken to go work at IQOQI Vienna

Languages

English fluent
French fluent
Italian native speaker
Spanish intermediate
German beginner

Computer skills

Mathematica, Python's numerical suite, C++, LaTeX, Office