Andrea Di Biagio

Research

2022–present **Postdoctoral Researcher**, Institute for Quantum Optics and Quantum Information (IQOQI) Vienna, Austria.

- o 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?'
 - o graduated with honours and special mention in the university-wide thesis prize

Education

- 2014–2016 **MSc in Applied Mathematics**, Imperial College London, United Kingdom.
 - o 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.
 - o thesis: 'Spacetime from causal structure'
 - thesis supervisor: Prof. Fay Dowker
 - $\circ\,$ 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.
 o graduated with honours

Publications and preprints

- 2024-11 G. Higgins, <u>ADB</u>, M. Christodoulou, *Truly relativistic gravity mediated entanglement protocol using superpositions of rotational energies*, Physical Review D **110**, L101901, arXiv:2403.02062.
- 2024-10 <u>ADB</u>, C. Rovelli, *On the Time Orientation of Probabilistic Theories*, Philosophy of Physics **2**, 1, 16, arXiv:2403.01062.
- 2024-09 Y. Ying, M. Maciel Ansanelli, <u>ADB</u>, 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, <u>ADB</u>, 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, <u>ADB</u>, 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 <u>ADB</u>, *Diagrams and GPTs for Quantum Gravity*, Quantum Views **8**, 78.
- 2023-11 E. G. Cavalcanti, <u>ADB</u>, C. Rovelli, *On the consistency of relative facts*, European Journal for Philosophy of Science **13**, 55, arXiv:2305.07343.
- 2023-05 <u>ADB</u>, 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, <u>ADB</u>, M. Aspelmeyer, Č. Brukner, C. Rovelli, R. Howl, *Locally me-diated entanglement through gravity from first principles*, Physical Review Letters **130** 100202, arXiv:2202.03368.
- 2022-10 M. Christodoulou, <u>ADB</u>, P. Martin-Dussaud, An experiment to test the discreteness of time, Quantum 6, 826, arXiv:2007.08431.
- 2022-07 M. Christodoulou, <u>ADB</u>, R. Howl, C. Rovelli, *Gravity entanglement, quantum reference systems, degrees of freedom*, Classical and Quantum Gravity **40**, 047001, arXiv:2207.03138.
- 2021-10 <u>ADB</u>, 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 <u>ADB</u>, P. Donà, C. Rovelli, *The arrow of time in operational formulations of quantum theory*, Quantum **5**, 520, arXiv:2010.05734.
- 2021-02 <u>ADB</u>, C. Rovelli, *Stable Facts, Relative Facts*, Foundations of Physics **51**, 30, arXiv:2006.15543.

Talks

- 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

- 2025-04 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 selforganised 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