

Alessandro Laneve

WORK EXPERIENCE

November 2022-Present **Post-doc Researcher**

Nanophotonics Group, University of Rome "La Sapienza", Rome, Italy

Project: EU project "Quantum Dots for Entanglement-based Quantum Key Distribution (QD-E-QKD)", <https://www.qd-e-qkd.eu/>

Principal investigator: Rinaldo Trotta

Description of the project: Entanglement is a fundamental ingredient for extending quantum key distribution from two-party communication to networks without trusted nodes. Yet, the commercial application of this concept is currently hindered by the probabilistic nature of the photon-generation process underlying the used entanglement resources. QD-E-QKD will develop a novel technology based on semiconductor quantum dots and test it in realistic urban communication scenarios to surpass the limits of current approaches to entanglement-based quantum key distribution.

EDUCATION AND TRAINING

October-December 2021 **Visiting PhD student**

Queen's University of Belfast, Belfast, United Kingdom

Local Supervisor: Mauro Paternostro

Aim of the collaboration: ideation and development of a general multipartite entanglement distribution protocol, through the employment of separable entanglement carriers.

November 2019–2023 **PhD in Physics**

University of Rome "La Sapienza", Rome, Italy

Project Title: Diverse Applications of the Quantum Walk model in Quantum Information: a theoretical and experimental analysis in the optical framework

Thesis Supervisor: Paolo Mataloni

Field of research: Quantum Optics, Quantum Information

Research topic: The thesis project focuses on the exploitation of the Quantum Walk model to theoretically and experimentally analyze the behavior of useful resources propagating in a network, in different frameworks.

2017–2019 **Master degree in Theoretical Physics**

University of Rome "La Sapienza", Rome, Italy

110/110 cum laude

Title: Theoretical and experimental analysis of super-diffusive processes by Quantum Walks

Supervisor: Paolo Mataloni

Description: The thesis topic relies on the properties of Quantum Walks (QW) using a bulk-optics experimental apparatus that allows to implement various disorder patterns through a set of tunable phases. Through that, it is possible to scan the region between the diffusive and ballistic behaviour of a QW by only imposing phase shifts, thus preserving the coherence features of the system.

2014–2017 **Bachelor degree in Physics**

University of Rome "La Sapienza", Rome, Italy

110/110 cum laude

Title: Principio di Landauer e Informazione Quantistica

Supervisor: Fabio Sciarrino

Description: The thesis focused on the thermodynamical foundation of classical and quantum information theory, through the definition of both and the analysis of their properties by the point of view of Landauer's principle.

2009–2014 Secondary School Diploma in Classics / Classical Studies

Liceo Classico Statale Torquato Tasso, Rome, Italy

100/100

June 2021 11th Optoelectronics and Photonics Summer School NMP2021 NEU-ROMORPHIC PHOTONICS

Organized by University of Trento and the Institute for Cross-Disciplinary Physics and Complex Systems (IFISC) of the University of the Balearic Islands

Monte Bondone -Trento, Italy

Description: the school aimed at introducing students and post-docs with an optics background to the concepts of neuromorphic photonics, focusing on the hot topics that are driving the technological and scientific research in this field.

September 2021 Corso di Alta Formazione: La comunicazione della scienza (Science communication)

Organized by Department of Biology and Biotechnology of Sapienza University of Rome
Rome, Italy

Description: the course consisted of two parts: the first providing a general class about public speaking in english, while the second focused on the communication of scientific concepts to the wide public.

November-December 2023 Sapienza Soft Skills

Organized by Sapienza University of Rome

Rome, Italy

Description: the cross-disciplinary training program on soft skills aimed at enhancing the training path of PhD students and diversifying the skills of Early-Stage Researchers. Topics ranged from participation in European funding programs in the field of R&I to research result valorization and management systems, from Intellectual Property protection to ethical implications of research, from scientific communication to the Third Mission, from entrepreneurship to scientific calculation tools and Big Data. .

TEACHING

March-June 2022 Tutor for the course of "Fisica Generale per Scienze Geologiche"

Dipartimento di Scienze della Terra, Sapienza, University of Rome, Rome, Italy

Tutoring activity for the General Physics course taught to Geological Sciences bachelor students, in assistance to Prof. Michele Ortolani and Prof. Ettore Majorana.

RESEARCH GRANTS AWARDED

November 2024 Funding for "Progetto di Avvio alla Ricerca - Tipo 2"

Awarded by University of Rome "La Sapienza"

Project Title: Entanglement recovery via wavefront manipulation for enhanced Quantum Communication with Quantum Dots

Tutor: Rinaldo Trotta

November 2023 Funding for "Progetto di ricerca medio" with the role of "research group component"

Awarded by University of Rome "La Sapienza"

Project Title: On-demand polarization qubits from a symmetric optical microcavity

Principal investigator: Francesco Basso Basset

November 2022 Funding for "Progetto di Avvio alla Ricerca - Tipo 2"

Awarded by University of Rome "La Sapienza"

Project Title: Harnessing high-dimensional photonic systems for enhanced experimental Quantum State Discrimination with solid state single photon sources

Tutor: Rinaldo Trotta

October 2021 Funding for "Progetto di Avvio alla Ricerca - Tipo 1"

Awarded by University of Rome "La Sapienza"

Project Title: Experimental quest for Quantum State Discrimination strategies based on Quantum Networks and Machine Learning methods

Tutor: Paolo Mataloni

PUBLICATIONS

- 2022 **A scheme for multipartite entanglement distribution via separable carriers**, Laneve A., McAleese H., and Paternostro M., New Journal of Physics **24** (12), 123003
- 2022 **Experimental multi-state quantum discrimination through optical networks**, Laneve A., Galdi A., Hamiti F., Mataloni P., and Caruso F., Quantum Science and Technology **7** (2), 025028
- 2021 **Enhancing nonclassical bosonic correlations in a quantum walk network through experimental control of disorder**, Laneve A., Nosrati F., Galdi A., Shadfar M. K., Pegoraro F., Mahdavi-pour K., Lo Franco R., and Mataloni P., Phys. Rev. Research **3**, 033235
- 2021 **Readout of quantum information spreading using a disordered quantum walk**, Nosrati F., Laneve A., Shadfar M. K., Galdi A., Mahdavi-pour K., Pegoraro F., Mataloni P., and Lo Franco R., JOSA B, **38**(9), 2570-2578
- 2021 **Transient subdiffusion via disordered quantum walks**, Galdi A., De S. Laneve A., Barkhofen S., Sperling J., Mataloni P., and Silberhorn C., Physical Review Research **3** (2), 023052
- 2019 **Experimental investigation of superdiffusion via coherent disordered Quantum Walks**, Galdi A., Laneve A., Bonavena L. D., Sansoni L., Ferraz J., Fratalocchi A., Sciarrino F., Cuevas A., and Mataloni P., Physical Review Letters **123**, 140501

PREPRINTS

- 2024 **Experimental Multi-state Quantum Discrimination in the Frequency Domain with Quantum Dot Light**, Laneve A., Rota M. B., Basso Basset F., Beccaceci M., Villari V., Oberleitner T., Reum Y., Krieger T. M., Buchinger Q., Covre da Silva S. F., Pfenning A., Stroj S., Höfling S., Rastelli A., Huber-Loyola T., Trotta R., arxiv preprint arXiv preprint arXiv:2409.07875
- 2022 **Experimental Multi-state Quantum Discrimination in the Frequency Domain with Quantum Dot Light**, Laneve A., Rota M.B., Basso Basset F. Fiorente N. P., Krieger T.M., Covre da Silva S.F., Buchinger Q., Stroj S., Höfling S., Huber-Loyola T., Rastelli A., Trotta R., and Mataloni P., arxiv preprint arXiv:2209.08324

SCIENTIFIC ORAL COMMUNICATIONS

- July 2024 **Wavevector-polarization correlation in entangled photons from radiative cascades**, *Central European Workshop on Quantum Optics CEWQO 2024, Olomouc, Czech Republic*
- May 2024 **Polarization-wavevector correlation in entangled photons from cavity-embedded quantum dots**, *Quantum Matter International Conference - QUANTUMatter 2024 (San Sebastian, Spain)*
- November 2021 **Experimental Enhancement of non-classicality in bosonic correlations through a disordered Quantum Walk**, *Quantum Information and Measurements VI, organized by OPTICA (Virtual presentation)*

- November 2020 **Experimental analysis of superdiffusive transition dynamics in a disordered photonic Quantum Walk**, *Quantum Technology International Conference - QTech 2020 in Barcelona, Spain (Virtual presentation)*
- September 2020 **Manipulating non-classical correlations via inhomogeneous Quantum Walks**, *24th IMEKO TC4 International Symposium 22nd International Workshop on ADC and DAC Modelling and Testing (IMEKO TC-4 2020) in Palermo, Italy (Virtual Presentation)*

SCIENTIFIC POSTER PRESENTATIONS

- July 2023 **Experimental strategies for the identification of high-dimensional single photon states produced by Quantum Dots**, *Central European Workshop on Quantum Optics CEWQO 2023, Milan, Italy*
- December 2022 **Harnessing Quantum Dot light for quantum discrimination of high-dimensional single photon states**, *8th International Workshop on "Engineering of Quantum Emitters Properties (EQEP)", Stuttgart, Germany*
- September 2022 **Multipartite entanglement distribution via separable systems (Flash Talk)**, *SFB-BeyondC Conference 2022 "Frontiers of Quantum Information Science", Wien, Austria*
- July 2022 **Quantum state discrimination through experimental time- binning dynamics**, *15th International Conference on Quantum Communication, Measurement and Computing (QCMC), Lisbon, Portugal*
- June 2022 **Quantum multi-state discrimination through time-multiplexing photonic networks**, *5th Seefeld Workshop on Quantum Information, Seefeld, Tyrol, Austria*
- June 2021 **Quantum state discrimination via Quantum Network: a bulk-optics approach (Flash Talk)**, *11th Optoelectronics and Photonics Summer School NMP2021 NEUROMORPHIC PHOTONICS in Monte Bondone -Trento, Italy (Virtual presentation)*

OUTREACH ACTIVITIES

- May 2024 **QuanTour initiative** *Media content creation and outreach activities in the context of "Quan-Tour", an official outreach project of the DPG for the International Year of Quantum Science and Technology 2025*
- April 2024 **Italian Quantum Weeks**, *Guide to the exhibition "Dire l'indicibile: viaggio nella meccanica quantistica", organized by Italian Quantum Weeks and Sapienza.*
- April 2022 **Italian Quantum Weeks**, *Guide to the exhibition "Dire l'indicibile: viaggio nella meccanica quantistica", prganized by Italian Quantum Weeks and Sapienza.*