

Alessia Suprano

Curriculum Vitae

Education

- 2008–2013 **Experimental scientific high school diploma**, *Liceo Scientifico Statale "Enrico Fermi" (Gaeta, Italy)*
Final grade: 100/100
- 2013–2016 **Bachelor degree in Physics**, *Università degli Studi di Roma Sapienza (Rome, Italy)*
Final grade: 110/110 cum Laude
Title: Fenomeni di coerenza in ottica e statistica della radiazione
Supervisor: Paolo Mataloni
- 2016–2018 **Master degree in Physics of Matter**, *Università degli Studi di Roma "Sapienza" (Rome, Italy)*
Final grade: 110/110 cum Laude
Title Ingegnerizzazione di stati quantistici tramite quantum walk in momento angolare
Supervisor Fabio Sciarrino
Description In this thesis a quantum walks in the orbital angular momentum degree of freedom of photons is implemented and is exploited for d-dimensional quantum state engineering.
- 2018–2022 **PhD-Physics**, *Università degli Studi di Roma "Sapienza" (Rome, Italy)*
[Ph.D. Thesis Project](#)
Title *High-dimensional photonics resources for quantum information processing and quantum networks*
Supervisor Prof. Fabio Sciarrino

Description The thesis is focused on the implementation of photonic platforms realizing high-dimensional quantum states, applied to quantum information protocols and fundamental tests of quantum mechanics. In particular, we focused on two classes of high dimensional quantum states: those composed of a single qudit and those composed of n distinct qubits. On one side, encoding qudit states in the orbital angular momentum degree of freedom of single photons, we experimentally implemented protocols for engineering arbitrary states employing the quantum walk dynamics and, for detecting them with improved techniques using also machine learning-based approaches. On the other side, distributing polarization-entangled states of photons in network configurations, we proposed a scalable experimental platform to implement networks of growing size and different topologies. We employed these networks to perform device-independent protocols and detect their non-locality behaviors going beyond the standard bipartite Bell scenario and reaching more complex networks.

Awards

- 2013-2014 University taxes exoneration Studente Meritevole
- 2018-2021 Borsa di Dottorato offered by Sapienza Università di Roma
- 2020-2021 Progetti per Avvio alla Ricerca offered by Sapienza Università di Roma (importo: 1000 Euro)

Academic Appointments

- February 2022 - January 2023 **Post-doc fellowship at Quantum Lab**, *Sapienza Università di Roma*, within **CANCER SCAN** Fet-Open project
- February 2023 **Post-doc fellowship at Quantum Lab**, *Sapienza Università di Roma*, within **H2020 QUROPE** Fet-Open project

Outreach activities

- 2018-2021 **Member of RAYS (Rome Association of Young Scientist)**, *RAYS is Sapienza student chapter and is supported by the societies OSA (Optical Society of America) and SPIE (International Society for Optics)*
- 2019-2020 **Secretary of OSA Sapienza Student chapter**, *The chapter is supported by the american society OSA (The Optical Society).*
- 3rd April 2019 **Organization with RAYS of the workshop Quantum Leap: from Academia to industry**, *event with the goal to give an overview over the job opportunities after PhD studies*
- 2018 **Scientific divulgation in high schools with RAYS**, *Rome, Italy*
 - Istituto paritario Sant'Apollinare
- 2023 **Scientific divulgation in high school: Liceo Scientifico Enrico Fermi**, *Gaeta, Italy*

- 31 March - **Collaborator in the organization of the exhibition *Dire l'indicibile: la sovrapposizione quantistica*, Sapienza Università di Roma**
 12 April 2022 The exhibition aims at making accessible the fundamentals of quantum mechanics. Such an initiative is within the italian national outreach project *Italian Quantum weeks*
- 12 - 21 April 2023 **Collaborator in the organization of the exhibition *Dire l'indicibile: l'entanglement quantistico*, Sapienza Università di Roma**
 The exhibition aims at making accessible the fundamentals of quantum mechanics. Such an initiative is within the italian national outreach project *Italian Quantum weeks*

Computer skills

- Operating Systems Windows, Linux
- Programming Languages C/C++, Python
- Libraries SciPy library, TensorFlow, Keras
- Other Software Origin, Mathematica, $\text{\LaTeX}$, MATLAB, Microsoft Office package, OpenOffice package
- Graphics Inkscape
- Computer Certification ECDL (European Computer Driving Licence)

Languages

- Italian Mother tongue
- English Fluent
- French A2

School attended

- 3–7 July 2017 **Master School on New Frontiers in Optical Trapping and Optical Manipulation**
 ICFO
- 6–7 May 2019 **Machine Learning for Quantum Technology School**
 Max Planck Institute for the Science of Light
- 30 September–5 October 2019 **Quantum devices for non-classical light generation and manipulation, -Poster presentation: "Engineering of Quantum States through Quantum Walk in the Angular Momentum"**
 Ettore Majorana foundation and centre for scientific culture (Erice)
- 21-25 June 2021 **Cargese School of Quantum Information and Quantum Technology, -Poster presentation: "Engineering and characterization of Orbital Angular Momentum states", Cargese Scientific Institute (Cargese)**

Conference and Workshop attended

- 5-7 **Engineering of Quantum Emitter Properties**
December University of Rome Sapienza
2018
- 4-6 April **Quantum Information and Measurement QIM V: Quantum Technologies**, *Poster presentation: "Engineering of quantum states through quantum walk in the angular momentum"*, University of Rome Sapienza
2019
- 6-10 May **Machine Learning for Quantum Technology Workshop**, *-Contributed talk: "Experimental Protocol for Quantum State Engineering through one-dimensional Quantum Walk"*, Max Planck Institute for the Science of Light
2019
- 17-20 **Causality in the quantum world: harnessing quantum effects in causal inference problems**, *-Poster presentation: "Experimental Protocol for Quantum State Engineering through one-dimensional Quantum Walk"*
September 2019
Anacapri
- 20-21 January **Quantum Technologies within INFN: status and perspectives**, *-Contributed talk: "Certification of multi-photon experiments and Engineering and characterization of structured light"*
2020
University of Padova
- 25 June 2020 **Photonic Online Meet-up**, *-Poster presentation: "Engineering and characterization of structured light"*
Online
- 28 **Young IQIS 2020**, *-Contributed talk: "Manipulation and reconstruction of high-dimensional states "*
September-2
October 2020
Online
- 6-11 March **SPIE Photonics West (OPTO)**, *- Contributed talk: "Engineering and characterization of high-dimensional states"*
2021
Online
- 6-11 March **SPIE Photonics West (BIOS)**, *- Contributed talk: "Characterization of the transmission of structured light in scattering media"*
2021
Online
- 15-19 March **APS March Meeting 2021**, *- Contributed talk: "Manipulation and reconstruction of structured light"*
2021
Online
- 9-14 May **CLEO Laser Science to Photonics Applications**, *- Poster presentation: "Detection techniques of Orbital Angular Momentum states"*
2021
Online
- 18-20 May **Twinning in non-gaussian physics for quantum technology**, *- Poster presentation: "Experimental Engineering and Machine Learning-based detection of Orbital Angular Momentum states"*
2021
Online

- 1-5 November 2021 **Quantum Information and Measurement QIM VI: Quantum Technologies**, -
Contributed talk: "Real-time optimization of quantum state engineering protocol"
 Online
- 7-12 May 2023 **CLEO 2023**, - *Contributed talk: "Black-box optimization in quantum information protocols"*
 San Jose McEnery Convention Center in San Jose, California, USA
- 7-12 May 2023 **CLEO 2023**, - *Contributed talk: "Nonlocality detection in photonic triangle networks"*
 San Jose McEnery Convention Center in San Jose, California, USA
- 18-22 September 2023 **15th Italian Quantum Information Science Conference**, - *Poster presentation: "Nonclassicality detection in photonic triangle networks"*
 Trieste

Publications

- Giordani Taira, Polino Emanuele, Emiliani Sabrina, **Suprano Alessia**, Innocenti Luca, Majury Helena, Marrucci Lorenzo, Paternostro Mauro, Ferraro Alessandro, Spagnolo Nicolò and Sciarrino Fabio. Experimental Engineering of Arbitrary Qudit States with Discrete-Time Quantum Walks, **Phys. Rev. Lett., American Physical Society**, 2019, 122, 020503
- Taira Giordani, **Alessia Suprano**, Emanuele Polino, Francesca Acanfora, Luca Innocenti, Alessandro Ferraro, Mauro Paternostro, Nicolò Spagnolo and Fabio Sciarrino. Machine Learning-Based Classification of Vector Vortex Beams, **Phys. Rev. Lett., American Physical Society**, 2020, 124, 160401
- Ilaria Gianani, **Alessia Suprano**, Taira Giordani, Nicolò Spagnolo, Fabio Sciarrino, Dimitris Gorpas, Vasilis Ntziachristos, Katja Pinker, Netanel Biton, Judy Kupferman and Shlomi Arnon. Transmission of vector vortex beams in dispersive media. **Advanced Photonics**, 2020, 2(3), 036003
- Davide Poderini, Iris Agresti, Guglielmo Marchese, Emanuele Polino, Taira Giordani, **Alessia Suprano**, Mauro Valeri, Giorgio Milani, Nicolò Spagnolo, Gonzalo Carvacho, Rafael Chaves and Fabio Sciarrino. Experimental violation of n-locality in a star quantum network. **Nature Communications**, 2020, 11, 2467
- **Alessia Suprano**, Taira Giordani, Ilaria Gianani, Nicolò Spagnolo, Katja Pinker, Judy Kupferman, Shlomi Arnon, Uwe Klemm, Dimitris Gorpas, Vasilis Ntziachristos and Fabio Sciarrino. Propagation of structured light through tissue-mimicking phantoms. **Optics Express**, 2020, 28, 35427-35437
- Taira Giordani, Luca Innocenti, **Alessia Suprano**, Emanuele Polino, Mauro Paternostro, Nicolò Spagnolo, Fabio Sciarrino and Alessandro Ferraro. Entanglement transfer, accumulation and retrieval via quantum-walk-based qubit–qudit dynamics. **New Journal of Physics**, 2021, 23(2), 023012
- **Alessia Suprano**, Danilo Zia, Emanuele Polino, Taira Giordani, Luca Innocenti, Mauro Paternostro, Alessandro Ferraro, Nicolò Spagnolo and Fabio Sciarrino. Enhanced detection techniques of orbital angular momentum states in the classical and quantum regimes. **New Journal of Physics**, 2021, 23, 073014
- Iris Agresti, Beatrice Polacchi, Davide Poderini, Emanuele Polino, **Alessia Suprano**, Ivan Šupić, Joseph Bowles, Gonzalo Carvacho, Daniel Cavalcant and, Fabio Sciarrino. Experimental robust self-testing of the state generated by a quantum network. **PRX Quantum**, 2021, 2, 020346
- Rafael Chaves, George Moreno, Emanuele Polino, Davide Poderini, Iris Agresti, **Alessia Suprano**,

Mariana R Barros, Gonzalo Carvacho, Elie Wolfe, Askery Canabarro, Robert W Spekkens, Fabio Sciarrino. Causal networks and freedom of choice in Bell's theorem. **PRX Quantum**, 2021, 2, 040323

- **Alessia Suprano**, Danilo Zia, Emanuele Polino, Taira Giordani, Luca Innocenti, Alessandro Ferraro, Mauro Paternostro, Nicolò Spagnolo and Fabio Sciarrino, Dynamical learning of a photonics quantum state-engineering process. **Advanced Photonics**, 2021, 2, 066002.
- Iris Agresti, Davide Poderini, Beatrice Polacchi, Nikolai Miklin, Mariami Gachechiladze, **Alessia Suprano**, Emanuele Polino, Giorgio Milani, Gonzalo Carvacho, Rafael Chaves and Fabio Sciarrino. Experimental test of quantum causal influences. **Science Advances**, 2022, 8, eabm1515.
- Davide Poderini, Emanuele Polino, Giovanni Rodari, **Alessia Suprano**, Rafael Chaves and Fabio Sciarrino. Ab-initio experimental violation of Bell inequalities. **Phys. Rev. Research, American Physical Society**, 2022, 4, 013159.
- **Alessia Suprano**, Davide Poderini, Emanuele Polino, Iris Agresti, Gonzalo Carvacho, Askery Canabarro, Elie Wolfe, Rafael Chaves and Fabio Sciarrino. Experimental genuine tripartite nonlocality in a quantum triangle network. **PRX Quantum**, 2022, 3, 030342.
- Danilo Zia, Riccardo Checchinato, **Alessia Suprano**, Taira Giordani, Emanuele Polino, Luca Innocenti, Alessandro Ferraro, Mauro Paternostro, Nicolò Spagnolo, and Fabio Sciarrino. Regression of high dimensional angular momentum states of light. **Phys. Rev. Research, American Physical Society**, 2023, 5, 013142.
- Emanuele Polino, Davide Poderini, Giovanni Rodari, Iris Agresti, **Alessia Suprano**, Gonzalo Carvacho, Elie Wolfe, Askery Canabarro, George Moreno, Giorgio Milani, Robert W Spekkens, Rafael Chaves and Fabio Sciarrino. Experimental nonclassicality in a causal network without assuming freedom of choice. **Nature Communications**, 2023, 14, 909.
- **Alessia Suprano**, Danilo Zia, Mathias Pont, Taira Giordani, Giovanni Rodari, Mauro Valeri, Bruno Piccirillo, Gonzalo Carvacho, Nicolás Spagnolo, Pascale Senellart, Lorenzo Marrucci and Fabio Sciarrino. Orbital angular momentum based intra- and inter- particle entangled states generated via a quantum dot source. **Advanced Photonics**, 2023, 5(4).
- Davide Poderini, Giovanni Rodari, George Moreno, Emanuele Polino, Ranieri Nery, **Alessia Suprano**, Cristhiano Duarte, Fabio Sciarrino and Rafael Chaves. Device-independent witness for the nonobjectivity of quantum dynamics. **Physical Review A**, 2023, 108, 032201.
- **Alessia Suprano**, Danilo Zia, Luca Innocenti, Salvatore Lorenzo, Valeria Cimini, Taira Giordani, Ivan Palmisano, Emanuele Polino, Nicolò Spagnolo, Fabio Sciarrino, G Massimo Palma, Alessandro Ferraro and Mauro Paternostro. Experimental property-reconstruction in a photonic quantum extreme learning machine. **ArXiv**, 2023, preprint arXiv:2308.04543.

Proceedings Contributions

- **Alessia Suprano**, Taira Giordani, Emanuele Polino, Danilo Zia, Sabrina Emiliani, Francesca Acanfora, Luca Innocenti, Helena Majury, Lorenzo Marrucci, Alessandro Ferraro, Mauro Paternostro, Nicolò Spagnolo and Fabio Sciarrino. Engineering and characterization of high-dimensional states. **Proc. SPIE 11699, Quantum Computing, Communication, and Simulation**, 1169917, 2021
- Taira Giordani, Emanuele Polino, Sabrina Emiliani, **Alessia Suprano**, Nicolás Spagnolo, Fabio Sciarrino, Luca Innocenti, Helena Majury, Mauro Paternostro, Alessandro Ferraro, Lorenzo Marrucci. Engineering of Quantum States through Quantum Walk in the Angular Momentum. **Quantum Information and Measurement**, F5A. 48 2019

- **Alessia Suprano**, Danilo Zia, Emanuele Polino, Taira Giordani, Luca Innocenti, Alessandro Ferraro, Mauro Paternostro, Nicolò Spagnolo, and Fabio Sciarrino, Real-time optimization of quantum state engineering protocol, in **Quantum Information and Measurement VI F2C.4 2021**
- **Alessia Suprano**, Taira Giordani, Emanuele Polino, Danilo Zia, Nicolò Spagnolo, Fabio Sciarrino, Luca Innocenti, Alessandro Ferraro, and Mauro Paternostro. Detection techniques for Orbital Angular Momentum states. In **2021 Conference on Lasers and Electro-Optics (CLEO)**, pp. 1-2. IEEE, 2021.
- **Alessia Suprano**, Emanuele Polino, Danilo Zia, Davide Poderini, Giovanni Rodari, Taira Giordani, Luca Innocenti, Alessandro Ferraro, Mauro Paternostro, Rafael Chaves, Nicolò Spagnolo and Fabio Sciarrino. Black-box optimization in quantum information protocols. **2023 CLEO: Fundamental Science**, FM4A. 7, 2023.
- **Alessia Suprano**, Emanuele Polino, Davide Poderini, Giovanni Rodari, Iris Agresti, Giorgio Milani, Gonzalo Carvacho, Askery Canabarro, George Moreno, Elie Wolfe, Robert W Spekkens, Rafael Chaves and Fabio Sciarrino. Nonlocality detection in photonic triangle networks. **2023 Conference on Lasers and Electro-Optics (CLEO)**, pp 1-2 IEEE, 2023.