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**, *Universitá 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**, *Universitá 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 exploitated for d-dimensional quantum state engineering.
2018–2022	**PhD-Physics**, *Universitá 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)
February 2022 - January 2023	**Post-doc fellowship at Quantum Lab**, *Sapienza Università di Roma*, within **CANCER SCAN** Fet-Open project
Title	Diffusione di luce con momento angolare orbitale

Outreach activities

2018-Present	**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
31st March - 12nd April 2022	**Collaborator in the organization of the exhibition *Dire l'indicibile: la sovrapposizione quantistica***, *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, LaTeX, MATLAB, Microsoft Office package, OpenOffice package
Graphics	Inkscape
Computer Certification	ECDL (European Computer Driving Licence)

Languages

Italian	Mothertongue
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 December 2018	**Engineering of Quantum Emitter Properties** University of Rome Sapienza
4–6 April 2019	**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
6–10 May 2019	**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

17-20 September 2019	**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"* Anacapri
20-21 January 2020	**Quantum Technologies within INFN: status and perspectives**, *-Contributed talk: "Certification of multi-photon experiments and Engineering and characterization of structured light"* University of Padova
25 June 2020	**Photonic Online Meet-up**, *-Poster presentation: "Engineering and characterization of structured light"* Online
28 September-2 October 2020	**Young IQIS 2020**, *-Contributed talk: "Manipulation and reconstruction of high-dimensional states "* Online
6-11 March 2021	**SPIE Photonics West (OPTO)**, *- Contributed talk:"Engineering and characterization of high-dimensional states"* Online
6-11 March 2021	**SPIE Photonics West (BIOS)**, *- Contributed talk:"Characterization of the transmission of structured light in scattering media"* Online
15-19 March 2021	**APS March Meeting 2021**, *- Contributed talk:"Manipulation and reconstruction of structured light"* Online
9-14 May 2021	**CLEO Laser Science to Photonics Applications**, *- Poster presentation:"Detection techniques of Orbital Angular Momentum states"* Online
18-20 May 2021	**Twinning in non-gaussian physics for quantum technology**, *- Poster presentation:"Experimental Engineering and Machine Learning-based detection of Orbital Angular Momentum states"* Online
1-5 November 2021	**Quantum Information and Measurement QIM VI: Quantum Technologies**, *- Contributed talk:"Real-time optimization of quantum stateengineering protocol"* Online

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, Nicoló 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, Nicoló 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, Nicoló 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, Nicoló 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 Sciarrin. 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 (in press).

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**, Nicoló 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, Nicoló 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*.