



# Taira Giordani

## Curriculum Vitae

- 2011–2014 **Bachelor degree in Physics**, *Sapienza Università di Roma*, Rome, Italy.  
110/110 cum laude
- 2014–2016 **Master degree in Physics**, *Sapienza Università di Roma*, Rome, Italy.  
110/110 cum laude
- 2016–2019 **Ph.D. student in Physics**, *XXXII cycle*, *Sapienza Università di Roma*, Rome, Italy.
- July-October 2019 **Visiting student**, *Queen's University of Belfast*, Belfast, UK.
- February 2020 **Ph.D. degree in Physics**, *Sapienza Università di Roma*, Rome, Italy.

### Ph.D. Thesis Project

- Title *Photonic quantum walks as test-bed for learning protocols*
- Supervisor Prof. Fabio Sciarrino
- Description The thesis provides several methods for controlling and benchmarking the operations of a pivotal platform in quantum information processing, discrete-time quantum walk in single- and multi-particle regime. The benefits regarding this fruitful interconnection between classical optimization algorithms, learning protocols and quantum walks have been successfully tested in two physical systems that realize the dynamics in single-photon states. One platform envisages multiphoton states evolving through integrated optical circuits. In the second photonic architecture, quantum walks are encoded in the angular momentum of light.

### Awards and Fellows

- 2011–2014 University taxes exoneration *Studente Meritevole*
- 2011–2014 *Percorso di Eccellenza*, lectures addressed to outstanding bachelor students of Physics Department
- 2016–2019 *Borsa di Dottorato* offered by Sapienza Università di Roma

2019 *Borsa di mobilità congiunta per dottorandi di ricerca* offered by Sapienza Università di Roma

 Education



- November 2019 - March 2020 **Post-doc fellowship at Quantum Lab, Sapienza Università di Roma, within **CANCER SCAN** Fet-Open project.**
- Description Investigation on the propagation of structured light in dispersive media
- April 2020 – December 2021 **Post-doc fellowship at CLNS-IIT, Centro per le Nano-Scienze della vita, Istituto Italiano di Tecnologia, Rome, Italy.**
- Description Wavefront shaping for retinal super-resolution imaging
- January 2021 **Post-doc fellowship at Quantum Lab, Sapienza Università di Roma, within ERC Advanced Grant **QU-BOSS** project.**
- Description Hybrid photonic architectures for quantum information processing

### Teaching activities

- 2020–2021 **Seminar for the course *Advanced Quantum Information*, in the PhD program of the Physics Department, Sapienza Università di Roma.**
- 2020–2021 **Thesis Direction.**
- { **Co-advisor** of the **master thesis** by Mariagrazia Iuliano, *Boson Sampling in a reconfigurable continuously- coupled 3D photonic circuit*
  - { **Co-advisor** of the **master thesis** by Riccardo Checchinato, *Recognition of spatially modulated optical beams through Machine Learning regression.*
  - { **Co-advisor** of the **master thesis** by Valerio Mannucci, *Certification of Gaussian Boson Sampling via graph theory*
  - { **Co-advisor** of the **bachelor thesis** by Luca Zappaterra, *Nozioni teoriche ed implementazione satellitare del protocollo BB84 per la crittografia quantistica*

### Outreach activities

- 2016–Present **Member of RAYS (SPIE and OSA La Sapienza Student Chapter), RAYS** (Rome Association of Young Scientist) is a group of PhD students and master students in physics devoted to scientific divulgation and outreach activities. The chapter is supported by the american societies SPIE (Society of Photo-Optical Instrumentation Engineers) and OSA (The Optical Society).
- 2017–2019 **President of SPIE La Sapienza Student Chapter.**
- 2017–Present **Treasurer of OSA La Sapienza Student Chapter.**
- 31th May 2016 **Participation to the event #Eufactor Sapienza with RAYS, Rome, Italy.**
- 14-16th October 2016 **Participation to the event Maker Faire 2016 with RAYS, Rome, Italy.**
- 2016–2019 **Outreach seminaries in high schools with RAYS, Rome, Italy.**

- 18th August 2018 **Travel Grant award by SPIE**, participation to SPIE Student Leadership Workshop, San Diego, CA, USA.
- 14-16th September 2018 **Travel Grant award by OSA**, participation to OSA Student Leadership Workshop, Washington, DC, USA.
- January 2019 **Special Program Grant award by OSA**, the grant is addressed for outstanding chapter's activities.
- 3rd April 2019 **Organizer of QUANTUM LEAP: FROM ACADEMIA TO INDUSTRY workshop**, Event intended for PhD students or young Post Doc researchers within the fields of quantum information and quantum optics, with the goal to give an overview over the job opportunities outside academia.

### Computer skills

Operating systems	Linux, Microsoft Windows
Languages	C/C++, python, R
Libraries	SciPy library, TensorFlow, Keras
Graphics	Inkscape, Blender
Other softwares	Mathematica, LabView, MATLAB, L <sup>A</sup> T <sub>E</sub> X, Microsoft Office package, OpenOffice package

### Languages

Italian	<b>Mothertongue</b>
English	<b>Intermediate</b>

### Selection of conference presentations

- { **Contributed talk:** *"Large-scale reconfigurable continuously-coupled integrated optical circuits for photonic quantum information processing"*, OSA Quantum Information and Measurement VI, 1-5th November 2021, on-line conference
- { **Invited talk:** *"Vector Vortex Beams Propagation, Manipulation, and Detection in Classical and Quantum regime"*, 26th Microoptics Conference, 26-29th September 2021, on-line conference
- { **Contributed talk:** *"Certification of multi-photon experiment"*, Quantum technologies within INFN: status and perspectives, 20-21th January 2020, Padova, Italy.
- { **Contributed talk:** *"Validation of multi-photon interference in photonic boson sampling"*, Quantum Information and Measurement, 4-6th April 2019, Rome, Italy.
- { **Contributed talk:** *"Signature of multi-photon interference in boson sampling experiments"*, SPIE Optics + Photonics, 19-23th August 2018, San Diego, CA, USA.

{ **Contributed talk:** "*Quantum state engineering using one-dimensional discrete-time quantum walks*", Quantum techniques in machine learning, 6-8th November 2017, Verona, Italy.

{ **Contributed talk:** "*Observation of Majorization Principle for quantum algorithms via 3-D integrated photonic circuits*", 103-esimo Congresso nazionale Società Nazionale di Fisica, 11-15th September 2017, Trento, Italy.

{ **Poster contribution:** "*Engineering High-dimensional Entangled States via Discrete-time Quantum Walks*", CLEO 2021, on-line conference.

{ **Poster contribution:** "*Discrete-time Quantum Walks in the Angular Momentum of a Single Photon for Engineering Quantum States*", CLEO/Europe-EQEC 2019, 23-27th June 2019, Munich, Germany.

{ **Poster contribution:** "*Experimental quantum state engineering via discrete-time quantum walks in the angular momentum of a single-photon*", 5th International Conference on Optical Angular Momentum ICOAM 2019, 17-23th June 2019, Ottawa, Canada.

{ **Poster contribution:** "*Experimental statistical signature of many-body quantum interference*" Quantum machine learning and biomimetic quantum technologies, 18-23th March 2018, Bilbao, Spain.

{ **Poster contributions:** "*Experimental statistical signature of many-body quantum interference*"; "*Quantum state engineering using one-dimensional discrete-time quantum walks*", OSA Frontiers in Optics and Laser Science APS/DLS, 16-20th September 2018, Washington DC, USA.

## ————— Selection of most representative scientific publications

{ **T. Giordani**, F. Flamini, M. Pompili, N. Viggianiello, N. Spagnolo, A. Crespi, R. Osellame, N. Wiebe, M. Walschaers, A. Buchleitner, and F. Sciarrino, "Experimental statistical signature of many-body quantum interference", *Nature Photonics*, 12 (3), 173-178, 2018.

{ **T. Giordani**, E. Polino, S. Emiliani, A. Suprano, L. Innocenti, H. Majury, L. Marrucci, M. Paternostro, A. Ferraro, N. Spagnolo, and F. Sciarrino, "Experimental engineering of arbitrary qudit states with discrete-time quantum walks", *Physical Review Letters*, 122 (2), 020503, 2019.

{ **T. Giordani**, A. Suprano, E. Polino, F. Acanfora, L. Innocenti, A. Ferraro, M. Paternostro, N. Spagnolo, and F. Sciarrino, "Machine learning-based classification of vector vortex beams", *Physical Review Letters*, 124 (16), 160401, 2020.

{ **T. Giordani**, D. J. Brod, C. Esposito, N. Viggianiello, M. Romano, F. Flamini, C. Carvacho, N. Spagnolo, E. F. Galvão, and F. Sciarrino, "Experimental quantification of genuine four-photon indistinguishability", *New Journal of Physics*, 22 (4), 043001, 2020

- { **T. Giordani**, C. Esposito, F. Hoch, G. Carvacho, D. J. Brod, E. F. Galvão, N. Spagnolo, and F. Sciarrino, "Witnesses of coherence and dimension from multiphoton indistinguishability tests", *Physical Review Research*, 3 (2), 023031, 2021
- { **T. Giordani**, L. Innocenti, A. Suprano, E. Polino, M. Paternostro, N. Spagnolo, F. Sciarrino, and A. Ferraro, "Entanglement transfer, accumulation and retrieval via quantum-walk-based qubit-qudit dynamics", *New Journal of Physics*, 23 (2), 023012, 2021