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Chiara Esposito

Curriculum Vitae

Personal Information

First name	Chiara
Last name	Esposito
Place of birth	Avellino(Italy)
Date of birth	5th August 1991
Nationality	Italian

Education

2019-present **PhD in Physics**
University:"Sapienza Università di Roma"
Supervisor: Prof. F. Sciarrino
Subject: Quantum Optics, Quantum Information Research Group: Quantum Information Lab (www.quantumlab.com)
Description: Currently working on multiphoton interference for the achivement of the quantum advantage (Boson Sampling applications and validations) and for Quantum Simulation (Quantum Walks).

2014-2018 **Master's Degree in Physics**
University:"Università degli Studi di Napoli Federico II"
LM-17 - Laurea Magistrale in Fisica
Curriculum: Matter Physics
Date: 17/05/2018
Degree grade: 110/110
Weighted average of grades: 28.8/30
Supervisor: Prof. L. Marrucci and Dr. F. Cardano
Subject: Quantum Optics
Title:*"1D and 2D quantum walks with light transverse momentum"*
Abstract:"We have experimentally demonstrated a new quantum walk platform working with the transverse momentum of light. In our simulation we identify the beam, its transverse momentum value and its polarization respectively with the walker, the occupied lattice site and its coin state. The key element of the apparatus is the g-plate, an optical device which allows us to add or subtract a fixed transverse momentum components from the incoming beam depending on its polarization. We have simulated 1D and 2D quantum walk and quantum walks with an applied external force."

2010-2013 **Bachelor's Degree in Physics**
University:"Università degli Studi di Napoli Federico II"
L-30 - Laurea in Scienze e Tecnologie Fisiche
Date: 20/06/2014
Degree grade: 110/110 cum laude
Weighted average of grades: 28.8/30
Supervisor: Prof. A. Tagliacozzo
Title: Matter Physics
Title:*"Eccitazione elettronica localizzata su un difetto solitonico in una catena di poliacetilene"*

2010 **Diploma di Maturità Scientifica**
School: Liceo Scientifico V. Imbriani (Pomigliano d'arco, Italy)
Grade: 100/100

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Research Interests

Witnessing indistinguishability and coherence

In multiphoton interference, the indistinguishability of the involved photons and the quantumness of the photon states are fundamental for the achievement of the quantum advantage. We developed efficient methods for the characterization of multiphoton states produced by single-photon sources. We tested the indistinguishability and coherence of photons generated by a parametric down-conversion source through a bulk linear interferometer.

Boson Sampling on a 3D photonic chip

We implemented a Boson Sampling platform based on a 3D architecture of the optical circuits. By only measuring single photons and HOM visibilities, we have been able to completely the chip and reconstruct the sub-matrix.

Two dimensional Quantum walk exploiting G-Plate

We realized a two dimensional quantum walk by using a novel platform able to realize quantum interference experiments with the transverse momentum of photons. We investigated the walker evolution in the distinguishable as well as indistinguishable particle regimes and the changing of the final photon distributions among the transition between these regimes.

Two dimensional Quantum state engineering

We theoretically demonstrated the engineering of entangled two-qudit quantum state by exploiting the two dimensional quantum walk evolution. Experimentally, our platform allowed to engineer a great class of states in walker position space by tuning the parameters of the quantum walk. Then, we theoretically characterized a quantum channel obtained by two-dimensional quantum walk unitary evolution.

Experiences abroad

2016-2017 **Erasmus Programme**

Place: Madrid, España
University: Universidad Complutense de Madrid
Duration: 6 month
Activities:

- Attendance of the Bachelor course "Física Computacional" ;
- Attendance of the Master course "Métodos Experimentales Avanzados";

School Attendances and Contributions

2021 **Cargese School of Quantum Information and Quantum Technology**

Place: Cargese, Corsica, France
Duration: 21st-25th June 2021
Topics: *Physics, Computer Science and Quantum Engineering*

2021 **Poster Presentation to Cargese School of Quantum Information and Quantum Technology**

Place: Cargese, Corsica, France
Duration: 21st-25th June 2021
Title: "*Two-dimensional multiphoton Quantum Walk in transverse momentum of light*"
Insight:"We present an innovative platform feasible for the realization of two-dimensional multiphoton QW in the transverse momentum of light by using a new device called G-plate. We experimentally realize the 3 steps dynamic of two walkers in different initial positions on the lattice in the quantum regime. "

2019 **Quantum Connections in Sweden 6: Physics Summer School on Quantum Frontiers**

Place:"Högberga gard" Conference Centre, Lidingö, Sweden
Duration: 10th-22nd June 2019
Topics: *Quantum Matter, Quantum Information and Quantum Sensing*

Outreach Activities

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2019-present **University of Rome La Sapienza student chapter SPIE: Vice President**
Place:"Sapienza Università di Roma", Roma, Italy

2019-present **La Sapienza OSA Chapter: Member**
Place:"Sapienza Università di Roma", Roma, Italy

2018-present **RAYS member**
Place:"Sapienza Università di Roma", Roma, Italy
Activities:
- *Quantum Christmas*, Department of Physics, University of Rome Sapienza, Rome, Italy, December 20-21, 2018;
- *Quantum Leap: from academia to industry*, Aula Magna Regina Elena, Sapienza University of Rome, Rome, Italy, April 3, 2019;
- *Presentation of Chapter to "SPIE Optics+Photonics" conference* in San Diego, USA, August 11-15, 2019;

Languages

Italian	Mother-tongue
English	Fluent
Spanish	Fluent

Computer skills

Operative Systems
- Windows;
- Linux (Ubuntu, Arch);

Languages
- Python;
- C++;
- Wolfram;
- TEX;

Calculation and Data Analysis Sofware
- Wolfram Mathematica;
- MATLAB & Simulink;
- Maple;

Graphics editor
- Inkscape;
- AutoCAD;
- GIMP-GNU Image Manipulation Program.

Text editor
- Microsoft Office;
- TeXWork;

Conference and Workshop Contributions

2021 **Poster Presentation to CLEO Technical Conference and Exhibition 2021**
Online event
Duration: 9th-14th May 2021
Title: *"Witnesses of coherence and dimension from multiphoton indistinguishability tests"*
Insight:"We experimentally demonstrate the validity of witness tests on suitable interferometers designed for the purpose. Our findings confirm the effectiveness of this novel family of witness tests for capturing the quantum properties of high-dimensional systems."

2021 **Oral Presentation to APS March Meeting 2021**

Online event
Duration: 14th- 19th March 2021
Title: *"Two-dimensional multiphoton Quantum Walk in transverse momentum of light"*
Insight:"We present an innovative platform feasible for the realization of two-dimensional multiphoton QW in the transverse momentum of light by using a new device called G-plate. We experimentally realize the 3 steps dynamic of two walkers in different initial positions on the lattice in the quantum regime. "

2020 **Oral Presentation to Young IQIS 2020 - Young Italian Quantum Information Science Conference**

Online event
Duration: 28th September-2nd October 2020
Title: *"Witnesses of coherence and dimension from multiphoton indistinguishability tests"*
Insight:"We present an indistinguishability test for a multiphoton state based on an interferometer that allows measure simultaneously the three photon overlaps on a four photon state. We quantify the indistinguishability from the obtained value measured overlaps. Starting from these measurements we infer precise bounds for the unmeasured overlaps. We also formulate and test a coherence witness and dimension witness based on overlaps estimation. Our results provide a complete characterization of the single photon sources. "

2020 **Poster Presentation to 9th International Conference on Quantum Simulation and Quantum Walks**

Place: Centre International de Rencontres Mathématiques, Marseille, France
Duration: 20th-24th January 2020
Title: *"Experimental quantification of genuine four-photon indistinguishability"*
Insight:"We present an approach for the quantification of multiphoton indistinguishability based on two-photon HOM tests through a suitable interferometer without need of heralding. We show experimentally the validity of our approach and it represents a promising tool for the characterization of the deterministic or probabilistic future photon sources"

2019 **Poster Presentation to Causality in the quantum world: harnessing quantum effects in causal inference problems**

Place: Anacapri, Capri, Naples, Italy
Duration: 17th-20th September 2019
Title: *"Experimental quantification of genuine four-photon indistinguishability"*
Insight:"We present an approach for the quantification of multiphoton indistinguishability based on two-photon HOM tests through a suitable interferometer without need of heralding. We show experimentally the validity of our approach and it represents a promising tool for the characterization of the deterministic or probabilistic future photon sources"

2019 **Oral Presentation to SPIE Optics + Photonics**

Place: SPIE, San Diego Convention Center, San Diego, CA, United State of America
Duration: 11th-15th August
Title: *"Two-dimensional topological quantum walks in the momentum space of structured light"*
Insight:"We report the experimental realization of a 2D discrete-time quantum walk based on encoding the walker position in the transverse wavevector while the coin is encoded in the light polarization. The key element of this apparatus is the g-plate, which realize the walker translation. They allow us to add or subtract a fixed transverse momentum component of the incoming photons depending on their polarization. We benchmark our setup by implementing a periodically-driven Chern insulator and probing its topological features. In prospect, our platform could perform a 2D quantum walk on lattices with different geometry and more complex topologies."

2019 **Poster Presentation to Quantum Information and Measurement V: Quantum Technologies**

Place:"Sapienza Università di Roma", Rome, Italy
Duration: 4th-6th April
Title: *"Refocusing in forced photonic quantum walks controlled by liquid crystal gratings"*
Insight:"We mimic one dimensional forced quantum walks by using the photonic implementation obtained by means of a sequence of liquid-crystal devices ("g-plates"), which apply polarization-dependent transverse kicks to the photons in the beam. We observed refocusing phenomena for localized initial states."

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Publications

Under Review **Quantum walks of two correlated photons in a 2D synthetic lattice**
Authors: *Chiara Esposito, Mariana R. Barros, Andrés Durán Hernández, Gonzalo Carvacho, Francesco Di Colandrea, Raouf Barboza, Filippo Cardano,Nicolò Spagnolo, Lorenzo Marrucci, and Fabio Sciarrino*
Pubblication: *Under Review npj-Quantum Information*

15 June 2021 **Boson Sampling in a reconfigurable continuously-coupled 3D photonic circuit**
Authors: *Francesco Hoch, Simone Piacentini, Taira Giordani, Zhen-Nan Tian, Mariagrazia Iuliano, Chiara Esposito, Anita Camillini, Gonzalo Carvacho, Francesco Ceccarelli, Nicolò Spagnolo, Andrea Crespi, Fabio Sciarrino, Roberto Osellame*
Pubblication: *arXiv preprint arXiv: 2106.08260, June 2021.*
https://arxiv.org/pdf/2106.08260.pdf

9 April 2021 **Witnesses of coherence and dimension from multiphoton indistinguishability tests**
Authors: *Taira Giordani, Chiara Esposito, Francesco Hoch, Gonzalo Carvacho, Daniel J. Brod, Ernesto F. Galvão, Nicolò Spagnolo, and Fabio Sciarrino*
Pubblication: *Physical Review Research, Vol. 3, Issue 2, pag. 023031, April 2021.*
http://dx.doi.org/10.1103/PhysRevResearch.3.023031

2 April 2020 **Experimental quantification of genuine four-photon indistinguishability**
Authors: *Taira Giordani, Daniel J Brod, Chiara Esposito, Niko Viggianiello, Marco Romano, Fulvio Flamini, Gonzalo Carvacho, Nicolò Spagnolo, Ernesto F Galvão, Fabio Sciarrino*
Pubblication: *New Journal of Physics, Volume 22, April 2020,*
http://dx.doi.org/10.1088/1367-2630/ab7a30

23 January 2020 **Two-dimensional topological quantum walks in the momentum space of structured light**
Authors: *Alessio D'Errico, Filippo Cardano, Maria Maffei, Alexandre Dauphin, Raouf Barboza, Chiara Esposito, Bruno Piccirillo, Maciej Lewenstein, Pietro Massignan, Lorenzo Marrucci*
Pubblication: *Optica Vol. 7, Issue 2, pp. 108-114 (2020),*
https://dx.doi.org/10.1364/OPTICA.365028

Rome, 15/12/2021