Fulvio Flamini

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Professional experience

2020-2021 **Marie-Curie Research Fellow**.
University of Innsbruck – Advisor: Prof. Hans J Briegel.
Project: MAZINGER (*Mach-Zehnder and Interference Get Enhanced by Reinforcement Learning*)

2019-2020 **ESQ Postdoctoral Research Fellow**.
University of Innsbruck – Advisor: Prof. Hans J Briegel.
Project: Investigating the interplay between artificial intelligence and quantum technologies.

Roles Co-PI for the SFB-BeyondC project: *Models of quantum learning and computation*.

2016-2018 **Postdoctoral Research Fellow**.
Sapienza University of Rome – Advisor: Prof. Fabio Sciarrino.
Project: Development of validation protocols for multi-photon quantum interference.

Education

2013-2016 **Ph.D. in Physics**, ***with Honours***.
Sapienza University of Rome – Advisor: Prof. Fabio Sciarrino.
Thesis: *Implementation of integrated photonic experiments towards quantum technologies.*

Roles - Member of board of the Department of Physics.
- Member of the organizing committee for the Young IQIS Conference 2016.

2013 **Master's in Physics**, ***with Honours***.
Sapienza University of Rome – Advisor: Prof. Fabio Sciarrino.
Thesis: *Implementation and characterization of Boson Sampling with integrated photonics.*

Awards and Achievements

2016 **Piero Brovetto Prize**, awarded by the Italian Physical Society *for the theoretical and experimental contributions to the development of thermo-reconfigurable photonic devices*.

2016 Highlight in: *Horiuchi N, Reconfigurable circuits, Nature Photonics 10, 73 (2016).*

2015 Collaboration in the project *Gamma: monitoring and registration of the environmental storage parameters* for the Finmeccanica industrial innovation prize. The project was judged *among the most valuable presented*.

2007 Inclusion in the national register for high school students graduated with Honours.

Funding and Grants

Research

2021-2022 Marie Skłodowska-Curie Individual Fellowship (**MSCA-IF**).

2021 **ESQ Discovery Grant**, granted by the *Erwin-Schrödinger Center for Quantum Science and Technology* (ESQ). Project: *Projective simulation with optical frequency combs: a continuous-variable approach on graph states*. Amount granted: 78,000 €.

2019-2020 ESQ PostDoctoral Fellowship (**MSCA-COFUND** No. 801110), granted by the *Erwin-Schrödinger Center for Quantum Science and Technology* (ESQ).

2015 Funding of a *Young Researcher Project*, granted by MIUR. Project: *Optimization of quantum sources at telecom wavelength*. Amount granted: 2,000 €.

2013-2016 Ph.D. scholarship, granted by Sapienza University of Rome upon public competition.

Outreach

2020 *Seeker: the Game.* Granted by "Förderkreis 1669 - Wissenschafft Gesellschaft" and "Doktoratskolleg Atoms, Light and Molecules". (20,000 € + 5,000 €)

2016 *SPIE education outreach Grant.* (4,000 $)

2016 *SPIE FOCUS conference Grant.* (4,000 $)

2016 *OSA centennial special event Grant.* (2,000 $)

2016 *SPIE officer travel Grant.*

Outreach activities

Seeker: the Game

2020-2021 Conception and development of a **game for science communication**, funded by "Förderkreis 1669 - Wissenschafft Gesellschaft" and "Doktoratskolleg Atoms, Light and Molecules".

RAYS

2015-2017 **Co-founder of RAYS** (Rome Association of Young Scientists), aimed at promoting activities of science communication and professional development in Optics.

– Achievement of 10,100 € to fund events for local outreach and professional development (see section on Funding and grants for details);
– Participation in *Futuro Remoto* (Naples, 2015) and in the *European Makers Faire* (Rome, 2016) with educational optics experiments for the general public;
– Member of the **Local Organizing Committee** for the Young Italian Quantum Information Science conference (2016), supported by RAYS;
– Organizing 10+ outreach events in high schools in Rome.

Roles Founder and President (Treasurer) of La Sapienza SPIE (OSA) Student Chapter.

Expertise

Soft skills

Supervision activities Co-supervision of 4 PhD students and 6 Master's students during experiments, data analyses and thesis preparation (2014-2018).

Management Promoting outreach initiatives, applying for funding, organizing conferences (see above).

Teamwork – Strong co-operative abilities, developed both with theorists and experimentalists.
– Expertise in the coordination of small teams in separate projects. Ability to manage small-size projects, converting high-level requirements in low-level tasks.

Hard skills

Computing Expertise in data analysis and numerical simulations.
Softwares: Mathematica (fluent). Languages: Python (fluent); R, CUDA-Python (basic).

Experimental Integrated quantum photonics, Femtosecond laser writing, Optical experiments design.

Presentation Proficient in PowerPoint. Expertise in **science communication** (e.g. papers, presentations and graphics), strengthened with seminars by world-class instructor Jean-luc Doumont.

Languages Italian (mother tongue), English.

Scientific community

Reviewer

Journals Nature Physics, Physical Review Letters, Physical Review A, Physical Review Applied, Quantum Science & Technology, Journal of Optics, Scientific Reports, Entropy, New Journal of Physics, Applied Sciences, Energies, IEEE Journal of Selected Topics in Quantum Electronics.

Board – Member of the Reviewer Board for Photonics.
– Topic Editor for Photonics.

Collaborators

Theory Prof. Dr. Andreas Buchleitner (Freiburg Institute for Advanced Studies, Freiburg, Germany)
Prof. Dr. Miguel A. Martin-Delgado (Universidad Complutense Madrid, Madrid, Spain)
Assoc. Prof. Ernesto F. Galvão (Universidade Federal Fluminense, Niterói, Brazil)
Assoc. Prof. Nathan Wiebe (University of Washington, Seattle, United States)
Dr. Mattia Walschaers (Laboratoire Kastler Brossel, Paris, France)

Experiments Prof. Markus Aspelmeyer (IQOQI, Austrian Academy of Sciences, Vienna, Austria)
Prof. Fabio Sciarrino (Sapienza University of Rome, Rome, Italy - Ph.D. advisor)
Dr. Roberto Osellame (Consiglio Nazionale delle Ricerche, Milan, Italy)
Dr. Vincenzo D'Ambrosio (Università di Napoli Federico II, Naples, Italy)

Dissemination at international conferences

Talks

2020 – (Invited) Photonics North 2020 (online).
Photonic architecture for reinforcement learning

2019 – MSCA Falling Walls Lab contest (Brussels, Belgium).
Breaking the wall of Wall-E

– 1st DPG Fall Meeting on Quantum Science and Information Technologies (Freiburg, Germany).
Photonic architecture for reinforcement learning

2018 – (Invited) Kick-off Meeting Freiburg-Nagoya project (Freiburg, Germany).
Validating multi-photon quantum interference with pattern recognition

– Visiting seminar (Innsbruck, Austria).
Learning to distinguish quantum indistinguishability

2015 – Workshop on quantum simulation and quantum walks (Yokohama, Japan).
Quantum suppression law in a 3D photonic circuit implementing the Fast Fourier Transform

2015 – PICQUE scientific school in integrated quantum photonics applications (Rome, Italy).
Thermally-reconfigurable laser written photonic circuit for applications at telecom wavelength

2014 – 100° National Conference SIF (Pisa, Italy).
Experimental validation of photonic Boson Sampling

Posters

2020 – Quantum Optics 2020 (Obergurgl, Austria).

2019 – Austrian Quantum Information Conference 2019 (Vienna, Austria).
– Graduate Conference on Complex Quantum Systems (Vienna, Austria).
– Quantum Computing - From Algorithms to Applications (Obergurgl, Austria).
Photonic architecture for reinforcement learning

– Quantum Information and Measurement (QIM) V: Quantum Technologies (Rome, Italy).
Visual assessment of multi-photon interference

2016 – Workshop on quantum simulation and quantum walks (Prague, Czech Republic).
Validating multi-photon interference on three-dimensional laser-written quantum circuits

– Italian Quantum Information Science Conference (Rome, Italy).
Thermally-reconfigurable laser written photonic circuit for applications at telecom wavelength

– SPIE Optics + Photonics (San Diego, California).
Outreach activities with RAYS and Sapienza SPIE Student Chapter

2015 – QUTE-EUROPE summer school (Goteborg, Sweden).
Thermally-reconfigurable photonic circuit at telecom wavelength by femtosecond laser writing

2014 – Italian Quantum Information Science Conference (Salerno, Italy).
Experimental validation of Boson Sampling on a photonic integrated circuit

– PICQUE school: integrated photonic manipulation for quantum applications (Varenna, Italy).
Non-monotonic trend of bosonic coalescence within Boson Sampling architecture

– School on quantum physics and quantum information (Olomouc, Czech Republic).
Experimental realization of Boson Sampling and validation against uniform distribution

Publications

Citations Google Scholar: 911 (h-index: 11); Web of Science: 521

1st author in 8 peer-reviewed papers, 1 conference proceedings.

Peer-reviewed publications

1. Flamini F, Walschaers M, Spagnolo N, Wiebe N, Buchleitner A, Sciarrino F,
Validating multi-photon interference with finite data,
Quantum Science and Technology **5**, 045005 (2020).

2. Flamini F, Hamann A, Jerbi S, Trenkwalder L M, Poulsen Nautrup H, Briegel H J,
Photonic architecture for reinforcement learning,
New Journal of Physics **22**, 045002 (2020).

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

4. Flamini F, Spagnolo N, Sciarrino F,
Visual assessment of multi-photon interference,
Quantum Science and Technology **4**, 2 (2019).

5. Agresti I, Viggianiello N, Flamini F, Spagnolo N, Crespi A, Osellame R, Wiebe N, Sciarrino F,
Pattern recognition techniques for Boson Sampling validation,
Physical Review X **9**, 011013 (2019).

6. Brod D J, Galvão E F, Viggianiello N, Flamini F, Spagnolo N, Sciarrino F,
Witnessing genuine multiphoton indistinguishability,
Physical Review Letters **122**, 063602 (2019).

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

8. Viggianiello N, Flamini F, Bentivegna M, Spagnolo N, Crespi A, Brod D J, Galvão E F, Osellame R, Sciarrino F, Optimal photonic indistinguishability tests in multimode networks,
Science Bulletin **63** (22), 1470-1478 (2018).

9. Flamini F, Viggianiello N, Giordani T, Bentivegna M, Spagnolo N, Crespi A, Corrielli G, Osellame R, Martin-Delgado M A, Sciarrino F, Observation of photonic states dynamics in 3-D integrated Fourier circuits, *Journal of Optics* **20**, 7 (2018).
10. Flamini F, Spagnolo N, Sciarrino F,
Photonic quantum information processing: a review,
Reports on Progress in Physics **82**, 1 (2018).
11. Viggianiello N, Flamini F, Innocenti L, Cozzolino D, Bentivegna M, Spagnolo N, Crespi A, Brod D J, Galvão E F, Osellame R, Sciarrino F, Experimental generalized quantum suppression law in Sylvester interferometers, *New Journal of Physics* **20**, 033017 (2018).
12. Flamini F, Spagnolo N, Viggianiello N, Crespi A, Osellame R, Sciarrino F, Benchmarking integrated linear-optical architectures for quantum information processing,
Scientific Reports **7**, 15133 (2017).
13. Flamini F, Viggianiello N, Bentivegna M, Spagnolo N, Mataloni P, Crespi A, Ramponi R, Osellame R, Sciarrino F, Generalized quantum fast transformations via femtosecond laser writing technique,
Interdisciplinary Information Sciences **23**, 115-118 (2017).
14. Crespi A, Osellame R, Ramponi R, Bentivegna M, Flamini F, Spagnolo N, Viggianiello N, Innocenti L, Mataloni P, Sciarrino F, Suppression law of quantum states in a 3D photonic fast Fourier transform chip, *Nature Communications* **7**, 10469 (2016).
15. Flamini F, Magrini L, Rab A S, Spagnolo N, D'Ambrosio V, Mataloni P, Sciarrino F, Zandrini T, Crespi A, Ramponi R, Osellame R, Thermally reconfigurable quantum photonic circuits at telecom wavelength by femtosecond laser micromachining,
Light: Science & Applications **4**, e354 (2015).
16. Bentivegna M, Spagnolo N, Vitelli C, Brod D J, Crespi A, Flamini F, Ramponi R, Mataloni P, Osellame R, Galvão E F, Sciarrino F, Bayesian approach to boson sampling validation,
International Journal of Quantum Information **12**, 1560028 (2015).
17. Bentivegna M, Spagnolo N, Vitelli C, Flamini F, Viggianiello N, Latmiral L, Mataloni P, Brod D J, Galvão E F, Crespi A, Ramponi R, Osellame R, Sciarrino F, Experimental scattershot boson sampling,
Science Advances **1**, e1400255 (2015).
18. Spagnolo N, Vitelli C, Bentivegna M, Brod D J, Crespi A, Flamini F, Giacomini S, Milani G, Ramponi R, Mataloni P, Osellame R, Galvão E F, Sciarrino F, Experimental validation of photonic boson sampling,
Nature Photonics **8**, 615–620 (2014).

Conference proceedings

1. Flamini F, and Sciarrino F,
Implementation and validation of photonic Boson Sampling,
Proceedings of the International School of Physics Enrico Fermi **198**, pp.111-130 (2018).
2. Spagnolo N, Vitelli C, Bentivegna M, Flamini F, Mataloni P, Sciarrino F, Brod D J, Galvão E F, Crespi A, Ramponi R, Osellame R, Experimental boson sampling with integrated photonics,
Research in Optical Sciences, QTh1A.3 (2014).

Book

2020 Self-published the novel "*Entangled*". This fiction is intended for the general public.