

Carvacho Vera Gonzalo

Curriculum Vitae

2017–Present **PostDoctoral Fellow**, *Università Degli Studi di Roma "La Sapienza"*, Rome (Italy).

Education

2004–2007 **Scientific/Humanist Studies High School**, *Colegio Sagrado Corazón De Jesús (San Carlos, Chile)*.

2007–2011 **Bachelor Degree in Physics**, *University of Concepción*, Concepción (Chile).

2012–2013 **Master Degree in Physics**, *University of Concepción*, Concepción (Chile).

Title *Stabilization and optical characterization of an installed Mach-Zehnder interferometer in optical fibers for quantum communications.*

Supervisor Prof. Guilherme Xavier

Final grade 70/70 with honours

2007–2013 **Physics Engineer**, *University of Concepción*, Concepción (Chile).

Title *Stabilization and optical characterization of an installed Mach-Zehnder interferometer in optical fibers for quantum communications.*

Supervisor Prof. Guilherme Xavier

Final grade 70/70

2014–2018 **PhD Degree in Physics**, *Università La Sapienza*, Rome (Italy).

Title *Multiphoton hybrid systems and their applications in quantum information and quantum communication.*

Supervisor Prof. Fabio Sciarrino

Final grade 30/30 with honours

Awards and Fellows

- 2012–2013 Scholarship for joint studies of undergraduate-graduate at the University of Concepción (2012).
- 2012-2013 Full-cover Scholarship for National Master studies awarded from the National Center for the Research (CONICYT)
- 2014-2017 Full-cover Scholarship for PhD studies abroad awarded from the National Center for the Research (CONICYT)
- 2017-2018 1 year Fellowship (Prot.2588/2017) "Quantum walks con differenti piattaforme"
- 2018-2020 2 years Fellowship from "The John Templeton Foundation" to work within the project "Q-CAUSAL" ID 61084

Computer skills

Programming in C++, python, mathematica, Fortran, Blender, Latex.

Languages

Spanish	Mothertongue	
Italian and English	Advanced	<i>Conversation and written language fluent</i>
Portoghese	High	

Participation in Research Projects

- 2013 **Experimental Quantum Cryptography and Violation of Bells Inequalities Employing Genuine Energy Time Entanglement in Long Optical Fibres**, Fondecyt Project number 11110115, *Ministry of Sciences (Chile)*.
- 2014 **Millennium Nucleus Advanced Optics**, *Ministry of Sciences (Chile)*.
- 2017 **QUCHIP Quantum Simulation on a Photonic Chip**, *European Research Council*.
- 2018 **PHOSPhOR Photonics of Spin Orbit Optical Phenomena**, *European Research Council*.
- 2019 **Q CAUSAL Causality in the quantum world harnessing quantum effects in causal inference problems**, *The John Templeton Foundation USA*.
- 2019 **Inferring cyberattacks from quantum correlations over installed optical fiber networks**, *Starting Research Grant from Sapienza University ITALY*.

Outreach Activities

- 2017 **Member of the Rome Association of young scientists (RAYS)**, *Group financially supported by the Optical Society (OSA, <https://www.osa.org/enus/home/>) and by the Society of Photo-Optical Instrumentation Engineers (SPIE, <http://spie.org/?SSO=1>)*

with the aim to promote the study of physics, and specifically, optics among high-school and bachelor degree students.

- 2018 **Organizer of the workshop "Quantum Christmas"**,
<http://www.quantumlab.it/workshop-quantum-christmas/>.
- 2019 **Local Organizing Committee member of the workshop "Quantum Processing of Big Data: from quantum computing to earth observation"**,
<https://www.quantumlab.it/qim2019/esa-workshop/>.
- 2019 **Local Organizing Committee member of the Conference "Quantum Information and Measurement (QIM) V: Quantum Technologies"**,
<https://www.quantumlab.it/qim2019/>.

Conferences

- Second Joint Meeting of the Uruguayan Physical Society and the Association of Physical Argentina SUF-AFA, Universidad de la Republica de Montevideo, Uruguay (2011).
- XVIII Chilean Physics Symposium, Universidad de la Serena, Chile (2012)
- QKD Summer School, Institute for Quantum Computing, University of Waterloo, Canada (2013)
- Qcrypt 2013, Institute for Quantum Computing, University of Waterloo, Canada (2013)
- Qcrypt 2014, Telecom Paris-Tech, France (2014)
- PICQUE Roma Scientific School, Italy (2015)
- V Quantum Information School and workshop, Brazil (2015)
- 101 Congresso della società italiana di Fisica, Italy (2015)
- 606. Wilhelm und Else Heraeus-Seminar on Nanophotonic and Complex Spatial Modes of Light, Germany (2016)
- RICE school New Trends in Quantum Information and ICE-3 Conference, Spain (2016)
- International Conference on the Frontiers in Atomic, Molecular, and Optical Physics, China (2016)
- 9th Italian Quantum Information Science Conference, Italy (2016)
- Quantum Contextuality in Quantum Mechanics and Beyond, Czech Republic (2017)
- Quantum Christmas Workshop, Italy (2018)
- Quantum Horizon symposium, Italy (2018)
- ESA Workshop: Quantum Processing of big data: From quantum computing to Earth observation, Italy (2019)
- Quantum leap: From academy to Industry, Italy (2019)
- Quantum Information and measurement (QIM) V: Quantum technologies, Italy (2019)
- It from Qubit school/workshop, Japan (2019)
- Conference on Uncertainty in Artificial Intelligence, Israel (2019)
- 12th Italian Quantum Information Science Conference, Italy (2019)
- Causality in the quantum world, Italy (2019)

Publications

1. **Structural and transport characterization of ultra-thin Ba_{0.05}Sr_{0.95}TiO₃ layers grown over Nb electrodes for the development of Josephson junctions**, M. Sirena, L. Aviles Felix, G. Carvacho, H. L. Navarro Fernandez, L. B. Steren, R. Bernard, J. Briatico, N. Bergeal, J. Lesueur, and G. Faini, Applied Physics Letters 100, 012602 (2012).

2. **Long-distance distribution of genuine energy-time entanglement**, A. Cuevas, G. Carvacho, G. Saavedra, J. Cariñe, W.A.T. Nogueira M. Figueroa, A. Cabello, P. Mataloni, G. Lima and G.B. Xavier, *Nature Communications* 4, 2871(2013).
3. **Post-Selection Loophole-Free Bell Test over an Installed Optical Fiber Network**, G. Carvacho, J. Cariñe, G. Saavedra, A. Cuevas, J. Fuenzalida, F. Toledo, M. Figueroa, A. Cabello, J. Larsson, P. Mataloni, G. Lima and G.B. Xavier, *Phys. Rev. Lett.* 115, 030503 (2015).
4. **Entangled vector vortex beams**, V. D'Ambrosio, G. Carvacho, F. Graffitti, C. Vitelli, B. Piccirillo, L. Marrucci and F. Sciarrino. *Phys. Rev. A* 94, 030304 (R) (2016).
5. **Experimental investigation on the geometry of GHZ states** G. Carvacho, F. Graffitti, V. D'Ambrosio, B. Hiesmayr and F. Sciarrino. *Scientific Reports* 7, 13265 (2017).
6. **Experimental violation of local causality in a quantum network**, G. Carvacho, F. Andreoli, L. Santodonato, M. Bentivegna, R. Chaves and F. Sciarrino. *Nature Communications* 8, 14775 (2017).
7. **Experimental bilocality violation without shared reference frames**, F. Andreoli, G. Carvacho, L. Santodonato, M. Bentivegna, R. Chaves and F. Sciarrino. *Phys. Rev. A* 95, 062315 (2017).
8. **Maximal quantum violation of n-locality inequalities in a star-shaped quantum network**, F. Andreoli, G. Carvacho, L. Santodonato, R. Chaves and F. Sciarrino. *New Journal of Physics* 19, 113020 (2017).
9. **Single-photon quantum contextuality on a chip**, A. Crespi, M. Bentivegna, I. Pitsios, D. Rusca, D. Poderini, G. Carvacho, V. D'Ambrosio, A. Cabello, F. Sciarrino and R. Osellame. *ACS Photonics* 4, (2017).
10. **Quantum violation of an instrumental test**, R. Chaves, G. Carvacho, I. Agresti, V. Di Giulio, L. Aolita, S. Giacomini and F. Sciarrino. *Nature Physics* 10,1038 (2017).
11. **Experimental study of nonclassical teleportation beyond average fidelity**, G. Carvacho, F. Andreoli, L. Santodonato, M. Bentivegna, V. D'Ambrosio, P. Skrzypczyk, I. Supic, D. Cavalcanti and F. Sciarrino. *Phys. Rev. Lett.* 121, 140501 (2018).
12. **Challenging local realism with human randomness**, The BIG Bell Test Collaboration, *Nature* 557, 212-216 (2018).
13. **Device-independent certification of a quantum delayed choice experiment**, E. Polino, I. Agresti, D. Poderini, G. Carvacho, G. Milani, G.B. Lemos, R. Chaves and F. Sciarrino, *Phys. Rev. A* 100, 022111 (2019).
14. **Perspectives on experimental quantum causality**, G. Carvacho, R. Chaves and F. Sciarrino, *EPL (Europhysics Letters)* 125, 3 (2019).
15. **Experimental learning of quantum states**, A. Rocchetto, S. Aaronson, S. Severini, G. Carvacho, D. Poderini, I. Agresti, M. Bentivegna and F. Sciarrino. *Science Advances* 5, eaau1946 (2019).
16. **Tunable two-photon quantum interference of structured light**, V. D'Ambrosio, G. Carvacho, I. Agresti, L. Marrucci and F. Sciarrino. *Phys. Rev. Lett.* 122, 013601 (2019).
17. **Experimental semi-device-independent tests of quantum channels**, I. Agresti, D. Poderini, G. Carvacho, L. Sarra, R. Chaves and F. Sciarrino. *Quantum Science and Technologies* (2019).
18. **Air-core fiber distribution of hybrid vector vortex-polarization entangled states**, D. Cozzolino, E. Polino, M. Valeri, G. Carvacho, D. Bacco, N. Spagnolo, L. K. Oxenlowe and F. Sciarrino.

Advanced Photonics, 1 (4), 046005 (2019).

19. **Exclusivity graph approach to Instrumental inequalities**, D. Poderini, R. Chaves, I. Agresti, G. Carvacho, F. Sciarrino, Proceedings of Conference on Uncertainty in Artificial Intelligence (UAI) (2019)
20. **Experimental quantification of genuine four-photon indistinguishability**, T. Giordani, D. J. Brod, C. Esposito, N. Viggianiello, M. Romano, F. Flamini, G. Carvacho, N. Spagnolo, E. F. Galvao and F. Sciarrino, New Journal of physics 22, 043001 (2020)
21. **Experimental device-independent certified randomness generation with an instrumental causal structure**, I. Agresti, D. Poderini, L. Guerini, M. Mancusi, G. Carvacho, L. Aolita, D. Cavalcanti, R. Chaves and Fabio Sciarrino. Communication Physics 3, 110 (2020).
22. **Experimental violation of n-locality in a star quantum network**, D. Poderini, I. Agresti, G. Marchese, E. Polino, T. Giordani, A. Suprano, M. Valeri, G. Milani, N. Spagnolo, G. Carvacho, R. Chaves and F. Sciarrino, Nature Communications 11, 2467 (2020).
23. **Quantum key distribution with entangled photons generated on-demand by a quantum dot**, F. Basso Basset, M. Valeri, E. Roccia, V. Muredda, D. Poderini, J. Neuwirth, N. Spagnolo, M. Rota, S. F. Covre da Silva, G. Carvacho, F. Sciarrino and R. Trotta, Manuscript under review in Nature Photonics (2020).

Selected Research Highlight

- 🔗 **Tunable quantum interference**, Nature photonics **13**, 72 (2019)
- 🔗 **Physicists demonstrate violation of local causality in a quantum network**, Resonance science foundation (2018) <https://resonance.is/physicist-demonstrate-violation-local-causalityquantum-network/>
 - 🔗 **BIG Bell Test: un esperimento globale di fisica quantistica**, FOCUS Magazine (2018) <https://www.focus.it/scienza/scienze/big-bell-test-un-esperimento-globale-di-fisica-quantistica>
- 🔗 **Il Big Bell Test smentisce il realismo locale**, Le Scienze (2018)
- 🔗 **Rai3 Interview- Scientists in Italy**, (2018)
- 🔗 **Transmission of Quantum-Correlated Structured Light in Air-Core Fiber**, SPIE (2019)