

CV of Paolo Villorosi - Apr. 2019

Full Professor of Physics (Professore Ordinario)
Department of Information Engineering - University of Padova
Affiliated to:
INFN, Sezione di Padova
CNR, Istituto di Fotonica e Nanotecnologie



Career track

- Born in Treviso, Italy, 12/11/1962.
- Degree in Physics in 1987, University of Padova.
- *Istituto Veneto di Scienze Lettere ed Arti* Fellowship during 1988 at the Risoe National Laboratory (Denmark).
- Post graduated *Perfezionamento* in Applied Mathematics, University of Padova, 1990/1991.
- Fellowships at the University of Padova from 1990 to 1994
- Permanent position as Researcher, University of Padova, 1994.
- Permanent position as Professor of Experimental Physics (II f.), University of Padova, 2005.
- Permanent position as Professor of Experimental Physics (I f.), University of Padova, 2015.

Roles

- Member of the Board of Stakeholders of the European Technological platform Photonics21
- National delegate for Action COST Nanoscale Quantum Optics
- Deputy National Delegate for COST Action Quantum Physics in Space
- Associate Editor of Scientific Reports (Nature Pub.)
- Coordinator of the Study Group for Quantum Communication in Space in Europe
- Member of the Executive Board of Department of Information Engineering, UniPD.

Research activities and research coordination:

My scientific activity has ever addressed frontier research topics. I endeavored to realize experimental investigations of the essence of the interaction between radiation and matter, as in the case of absorption spectra of transient ionic species exploiting laser-produced plasma (1990-2000), the underlying mechanism of multiphoton photoionization using few-femtosecond pulse excitation, published in Nature in 2001 (1999-2003), the laser harmonic generation of very high order, and the mutual phase relations which has allowed us to arrive in 2006 to generate the shortest artificial event ever produced, 130 attoseconds, limit unsurpassed for over two years, that appeared in Science (1994-2010).

Since 2003 I have proposed, carried out and coordinated researches aimed at extending the limits of the Quantum Communication and its protocols. In the period 2003-2008 I coordinated the work that has shown the first exchange to single photon from a satellite. I then coordinated the investigation of the exchange of quantum states along the longest link on ground, between two Canary Islands, in order to study the characteristics of very long and turbulent paths, as well as the realization of quantum protocols as the exchange of quantum key using Quantum-Key-Distribution (QKD).

Since 2010, I am coordinating the investigation on the Quantum Communication from a transmitter in orbit to a telescope on Earth. The first ever demonstration is reported by our group in Physical Review Letters on July 2015. Further researches covered the first demonstration in Space of the superposition principle using temporal (2016) and the realization in Space of the test of the wave-particle duality in Space (Wheeler Gedankenexperiment of the delayed choice), in 2017.

My activity as research coordinator was focused in the recent years to realize the scientific program of the Strategic Research Project of Padova University QuantumFuture, and developing what the Strategic Project of Department of Information Engineering QUINTET for the formation of new research teams, for both of which I had the role of coordinator.

This required different actions: establish the new Quantum Communication Laboratory and provide it with most advanced equipment, conceive and implement operational programs of research, integrating the Project four Units in common research subjects, promote an effective didactical activity in the field of Quantum Information at the level of PhD School, of the Galilean School of Higher Studies and enhancing the content in the course of Quantum Electronics and also start to PhD a significant group of motivated and

capable students. As a result, QuantumFuture supported research training for more than 35 man-years, not counting undergraduates.

Coordination activities also included the organization of two Quantum Communications Graduate Schools in Asiago in 2011 and 2013, two public demonstrations of the themes of Quantum Communication, at the Palazzo della Ragione in 2011 and at the Centro Altinate in 2013 and finally the organization in Padua in 2012 the Italian Fifth Quantum Information Science Conference, in Padova and on a School for Quantum Communication within a Marie-Curie-ITN in 2018.

For the **INFN-CSN2**, since 2015 I coordinate the Padova Unit on the MoonLIGHT-2 Project (2013-2018) with National Coordinator Dr. Simone Dell'Agnello, aiming at the study of the Laser Ranging system for accurate measurements of the Earth-Moon distance.

I also lead the INFN/Univ-Padova participation in the INFN-NASA/SSERVI Affiliation.

I have investigated novel laser processes of interest in Medicine and material processing, including using of femtosecond CPA (chirped-pulse-amplification) sources in nanotechnology, high power semiconductor and fiber laser for photovoltaics technology, adaptive optics for nonlinear interaction optimization, advanced optical systems for semiconductor lasers, laser surgery of lung, laser dentistry.

I am author of publications on several scientific journals including Science, Nature, Nature Physics, Nature Communications, on encyclopaedia and congresses in the areas of Quantum Communication, Quantum Optics, laser-matter interaction and Atomic and Plasma Physics. I gave invited talks in Europe, Asia and Americas, as well as referee for international journals and international research projects.

I served as coordinator in several national and international research projects, including the area of high order harmonics generation, space quantum communication, application of laser in Medicine and Industry.

I was member of the Board of the Institute for Photonics and Nanotechnology of the CNR from the foundation to 2014.

I am co-author of 11 patents or PCT.

I am teaching Course in Physics and Quantum Information, Electronics and Communications since 1990. I supervised 13 PhD Theses, and over 110 *Laurea* Thesis.

I was appointed by the United Nation organization **UNIDO** to organize a Course and to give lectures in Spanish in Guatemala on laser technologies, for small and medium enterprises in the Central America region.

Representing the Ministry of Education, I took part in the December 2013 to the negotiating table on Scientific Cooperation between the United States and Italy, at the US Department of State in Washington. My action has led to the inclusion, for the first time, the theme of Communication and Quantum Information of the topics included in the treaty signed at the end of the negotiations. In order to implement the agreement, I met in 2014 the respective representatives of the National Science Foundation (Arlington, VA) and NIST (Gaithersburg MD). As a result, in June 2015 I co-organized at the Italian Embassy in Washington the first Workshop *The Quantum Network: Promoting a US-Italy Scientific Cooperation on Quantum Information and Communications* fostering the strengthening of the bilateral networking.

From 2013, I represented the University of Padua at meetings with the National Delegates to the European Commission for Horizon 2020 in the areas ICT, Secure Societies and Transports, as well as meeting with Members of European Parliament in Brussels.

I am co-organizing the workshop with title *Quantum Information on a Chip*, to be held in Oct. 2015 in Padova, to establish the 10-years future roadmap in the area of Integrated Quantum Information, sponsored by the US National Science Foundation.

Research record - Apr. 2019

Overall citations on Scholar (Google): 7779 - H-index on Scholar (Google): 41

Awards and Prizes

1. Winner of the first prize, with team VIVA, of **STARTCUP 2002 - L'idea diventa impresa** (now *Premio Nazionale dell'Innovazione*), the first competition among Italian Universities on best proposal that exploits for business a research idea, July 4, 2002.
2. Selected for one of the **20 Ideas of national relevance** for the 2-nd National Day for the Resarch, Rome, Oct. 1, 2003.
3. Winner of the first prize ex-aequo, with SISMA spa Schio (Vi), of the **4th Premio Regionale per l'Innovazione**, sponsored by Veneto Innovazione, on July 7, 2004.
4. Winner as supervisor of the prize **InTesi** for research thesis of industrial interest by Camera di commercio Vicenza, for the years 2005 and 2006, and of Premio InTesi sponsored by the Parco Scientifico e Tecnologico GALILEO, for the years 2005 and 2006.
5. Winner of the third prize with team Think Laser of the 1st **Premio Nazionale Il talento delle idee**, sponsored by Unicredit Banca - Fondazione La Fornace dell'Innovazione - IBAN - FinancIdea, on Nov. 27, 2007.

Publication extract

1. M. Avesani, D. G. Marangon, G. Vallone, and P. Villoresi, *Source-device-independent heterodyne-based quantum random number generator at 17 Gbps*, Nat. Commun., vol. 9, no. 1, p. 5365, Dec. 2018.
2. F. Vedovato, C. Agnesi, M. Tomasin, M. Avesani, J.-Å. Larsson, G. Vallone, and P. Villoresi, *Postselection-Loophole-Free Bell Violation with Genuine Time-Bin Entanglement*, Phys. Rev. Lett., vol. 121, no. 19, p. 190401, Nov. 2018.
3. F. Vedovato, C. Agnesi, M. Schiavon, D. Dequal, L. Calderaro, M. Tomasin, D. G. Marangon, A. Stanco, V. Luceri, G. Bianco, G. Vallone, and P. Villoresi, *Extending Wheeler's delayed-choice experiment to space*, Sci. Adv., vol. 3, no. 10, p. e1701180, Oct. 2017.
4. G. Vallone, D. Dequal, M. Tomasin, F. Vedovato, M. Schiavon, V. Luceri, G. Bianco, and P. Villoresi, *Interference at the Single Photon Level Along Satellite-Ground Channels*, Phys. Rev. Lett., vol. 116, no. 25, p. 253601, Jun. 2016.
5. G. Vallone, D. Bacco, D. Dequal, S. Gaiarin, V. Luceri, G. Bianco, and P. Villoresi, *Experimental Satellite Quantum Communications*, Phys. Rev. Lett., vol. 115, no. 4, p. 040502, Jul. 2015.
6. G. Vallone, V. D'Ambrosio, A. Sponselli, S. Slussarenko, L. Marrucci, F. Sciarrino, and P. Villoresi, *Free-Space Quantum Key Distribution by Rotation-Invariant Twisted Photons*, Phys. Rev. Lett., vol. 113, no. 6, p. 060503, Aug. 2014.
7. P. Villoresi, T. Jennewein, F. Tamburini, M. Aspelmeyer, C. Bonato, R. Ursin, C. Pernechele, V. Luceri, G. Bianco, A. Zeilinger, and C. Barbieri, *Experimental verification of the feasibility of a quantum channel between space and Earth*, New J. Phys., vol. 10, no. 3, p. 33038, 2008.
8. G. Sansone, E. Benedetti, F. Calegari, C. Vozzi, L. Avaldi, R. Flammini, L. Poletto, P. Villoresi, C. Altucci, R. Velotta, S. Stagira, S. De Silvestri, and M. Nisoli, *Isolated Single-Cycle Attosecond Pulses*, Science vol. 314, no. 5798, pp. 443-446, 2006.
9. G. G. Paulus, F. Grasbon, H. Walther, P. Villoresi, M. Nisoli, S. Stagira, E. Priori, and S. De Silvestri, *Absolute-phase phenomena in photoionization with few-cycle laser pulses*, Nature, vol. 414, no. 6860, pp. 182-184, 2001.
10. P. Villoresi, P. Ceccherini, L. Poletto, G. Tondello, C. Altucci, R. Bruzzese, C. De Lisio, M. Nisoli, S. Stagira, and G. Cerullo, *Spectral features and modeling of high-order harmonics generated by sub-10-fs pulses*, Phys. Rev. Lett., vol. 85, no. 12, p. 2494, 2000.