DAVID VITALI’S CURRICULUM VITAE

**Main steps of the professional career**

* Born in Narni (Italy) on 19/5/1964
* 1983-1988: Degree in Physics at the University of Pisa, with mark 110/110 "magna cum laude".
* 1988-1992: Ph.D. in Physics at the Scuola Normale Superiore in Pisa, with mark 70/70 "magna cum laude".
* January-June 1992: Visiting lecturer at the University of North Texas, Denton (USA).
* January-May 1993: INFM grant at the Pisa INFM research unit
* August 1993-October 2001: Researcher in Physics at the University of Camerino.
* November 2001-November 2015: Associate Professor of Physics of Matter at the University of Camerino, Faculty of Science and Technology
* November 2015-Today: Full Professor of Theoretical Physics at the University of Camerino, School of Science and Technology

**Main aspects of the research activity**

* **Author** of **174 papers on International journals with referee** and **50 proceedings and contributions to books**
* More than 7750 citations in the ISI database, Hirsch h-index **h = 44** (<http://www.researcherid.com/rid/B-7159-2011> ); more than 8000 citations and **h = 44** according to SCOPUS, (<https://www.scopus.com/authid/detail.uri?authorId=7006257995>). In Google scholar, more than 10800 citations and **h = 51** (<http://scholar.google.com/citations?user=VN5i0YMAAAAJ&hl=it> )
* **Invited speaker** at **58** international conferences (see below)
* **Guest editor** of the following publications: a) “Proceedings of the 3rd Workshop on Mysteries, Puzzles and Paradoxes in Quantum Mechanics”, Zeitschrift fur Naturforschung Section A 56 (1-2), 2001. b) **Topical Issue “Mysteries, Puzzles and Paradoxes in Quantum Mechanics IV: Quantum Interference Phenomena”,** Journal of Optics B: Quantum and Semiclassical Optics, Volume 4, Number 4, August 2002; c) “Quanta of Light, Matter, and Information: A Festschrift in honour of Paolo Tombesi”, Fortschritte der Physik, Volume 57, Issue 11-12, 2009.
* **Visiting scientist** at the following universities and research centers: Ecole Normale Supérieure de Paris (1997, 2000, 2002, 2006), University of Queensland, Brisbane (Australia) (1998), University of Oxford (1999), University of Innsbruck (2000, 2005), University of Wien (2005, 2006, 2018), University of Bonn (2007), University of Mainz (2007), MIT (Cambridge, MA) (2008), Caltech (2008), Yale (2011).
* **Visiting professor** at Universidad Autonoma de Barcelona (2006)
* **Research grant** for Senior Foreign Researchers offered by the City of Paris (France), for research activity at the Ecole Normale Supérieure de Paris. The research period took place from 1/09/2004 to 31/01/2005.
* **Referee** of the following international physics and optics journal: Optica, Optics Letters, “Journal of the Optical Society of America B”, Optics Express, Applied Optics, OSA Continuum, Nature, Science, “Nature Physics”, Nature Communications, “Physical Review Letters”, “New Journal of Physics”, “Physical Review A”, “Physical Review D”, “Journal of Physics A”, “Journal of Physics B”, “Europhysics Letters”, “European Journal of Physics D”, Journal of Optics, “Journal of Modern Optics”, “Physics Letters A”, Optics Communications, Chaos, Solitons and Fractals, Physica Scripta, Annalen der Physik.
* **Referee** of research projects for the Italian Ministry MIUR, for the European Commission within FP7 and Horizon 2020, for the Israel Science Foundation, for the “Fond Quebecois de la Recherche, for the French ANR, for the Austrian FWF, for the German DFG, for NWO, Nederland.

**Coordination of research programs**

* Local Principal Investigator (PI) of the University of Camerino associated to the EU FP5-IST-FET IP program "ACQUIRE" , (2000-2003).
* Local PI of the node of the University of Camerino of the Network of Excellence for Quantum Information Processing and Communication (QUIPROCONE), funded by EU within the FET framework, (2000-2003).
* Local PI of the National research program PRIN 2001 "Decoherence control in quantum information processing”
* PI of the National research Program PRIN 2005 "Generation, manipulation and detection of light for quantum communication"
* Local PI of the node of the University of Camerino of the STREP project within ICT FET Open Call FP7-ICT-2007-C, “Micro- and Nano-Optomechanical Systems for ICT and QIPC” (MINOS) (2008-2011)
* Local PI of the National research program PRIN 2011 "Development of ultra low-loss optical interferometers in the ponderomotive regime for quantum noise reduction in gravitational wave detectors and ultrasensitive detection of weak forces in micro-mechanical systems.”
* Local PI of the node of the University of Camerino of the FP7-PEOPLE-2011-ITN Project: cQOM - Cavity Quantum Optomechanics (2012-2016)
* PI of the ICT FET Open Call FP7-ICT-2011-C project “Interfacing quantum optical, electrical and mechanical systems” (iQUOEMS) (2013-2016)
* Local PI of the node of the University of Camerino of the H2020-2016-MSCA ETN Project: OMT – Optomechanical Technologies (2016-2020)
* Local PI of the node of the University of Camerino of the H2020-2016-FET-PROACTIVE Project: HOT – Hybrid Optomechanical Technologies (2017-2020)

**Academic and Scientific Administration and Organization activities**

* May 2006-May 2015: Coordinator of the License and Master Physics Program of the University of Camerino
* January 2010-December 2014, Head of the Physics Division of the University of Camerino
* July 2013-October 2017: Member of the Board of Directors of the University of Camerino
* November 2017-Today: Dean of the School of Science and Technology of the University of Camerino
* Member of the **Organizing Commitee of the following International conferences:** 
  1. “Quantum Communication, Measurement, and Computing”, July Capri, 3-8, 2000
  2. “Entanglement and decoherence”, Gargnano (BS), September 20-25, 1999;
  3. “Mysteries, Puzzles and Paradoxes in Quantum Mechanics”, Gargnano (BS), September 17-23, 2000;
  4. “Mysteries, Puzzles and Paradoxes in Quantum Mechanics”, Gargnano (BS), 27/08/2001-01/09/2001
  5. International Meeting “Foundations of Quantum Information” Università di Camerino, April 16–19, 2004.
  6. International Meeting “Recent Challenges in Novel Quantum Systems” Università di Camerino, July 6–9, 2005.
  7. “International Conference on Scalable Quantum Computing with Light and Atoms”, Cortina d’Ampezzo (BL), February 15-22, 2009
* **Director of the International Conference** "Quantum Interfaces with Nano-opto-electro-mechanical devices: Applications and Fundamental Physics", Erice, Italy, July 31 - August 5 2016,

**Teaching and supervising activities**

* From 1995/96 to 2002: “Nonlinear Optics” for the Master and Ph.D Degree in Physics, University of Camerino
* From 2002/03 to 2010: “Mathematical Methods for Physics”, Degree in Physics, University of Camerino
* From 2004/05 to 2006/07: “Statistical Physics”, Degree in Physics, University of Camerino
* From 2010 to 2017: Mechanics and Thermodynamics, Degree in Physics, University of Camerino
* From 2015 to today: Quantum Mechanics, Degree in Physics, University of Camerino
* From 2017 to today: Dynamics of Open Quantum Systems, Joint PhD Course on Quantum Technologies, University of Naples, University of Camerino, Italian National Research Council
* Supervisor of 22 Master Theses of the Master Degree in Physics of the University of Camerino.
* External supervisor of 4 Master Theses of the Master Degree in Physics of the University of Pisa and of 1 Master Thesis of the Master Degree in Physics of the University of Milan
* Supervisor of 25 Ph.D theses in Physics at the University of Camerino.
* Referee of 20 Ph.D theses in Physics, of the University of Palermo (1999), of the University of Salerno (2003, 2007), of the University of Milan (2004, 2005), of the Ecole Normale Supérieure de Paris (2000,2002), of the Scuola Normale Superiore di Pisa (2009), University of Copenhagen (2013, 2020), University of Vienna (2015), Danish Technical University (2016), Aarhus University (2017), of the Aalto University Helsinki (2016, 2018), of the University of Leiden (2017), of the University of Delft (2019)

#### Awards and Honors

* **In 2015 nominated as American Physical Society (APS) Fellow** “For groundbreaking work on cavity opto-mechanics, which proved to provide an ideal and flexible environment for quantum information processing and quantum-limited sensing; for proposing pioneering techniques to control decoherence in quantum systems.

#### BRIEF DESCRIPTION OF THE RESEARCH ACTIVITY

My research activity, which began in 1989, spreads across various fields of research. At the beginning I have studied various applications of **nonlinear stochastic systems**, as for example superconducting devices and optical and atomic systems.

Starting from 1993 my research interests focused more and more on the development of new **quantum mechanical devices**, concentrating in particular on **quantum optics** systems and on systems of few trapped atoms and ions.

These new research interests have been stimulated also by the simultaneous impressive development of the field of Quantum Information, which provides a new way of looking at Quantum Physics. In fact, the quantum laws ruling the behaviour of atomic and subatomic particles, also provide a new and efficient way of processing and exchange information. I have worked on some important aspects of **Quantum Information**. I have proposed and studied various schemes for the practical implementation of quantum computers, which could solve some problems (such as prime factoring) much faster than any “classical” computer. I have then also studied various aspects of **Quantum Communication**, either in the case of single photons and in the case of bright optical fields. I have studied a fascinating form of quantum communication, i.e., quantum teleportation, which consists in the transport to a remote distance of all the quantum properties (the exact quantum state) of a physical system. I have also studied quantum cryptography, i.e., how to use photons for encrypted communications and I have collaborated to install and develop the Quantum Optics Lab at the Department of Physics of the University of Camerino.

As witnessed by the good number of citations, some of my papers on the **control and reduction of quantum decoherence** are quite popular. Quantum decoherence is the phenomenon according to which quantum coherence (which is the key ingredient of any quantum information protocol) is destroyed by the interaction with the environment. In my research activity I have developed various decoherence control techniques, especially tailored for atomic and quantum optical systems. Another field in which I have obtained excellent results is the one concerning **optomechanical devices**, in which radiation pressure couples light with micro- and nano-mechanical oscillators and which can be used in order to implement **sensors of forces, masses, displacements with an incredibly high sensitivity**. These sensors are able to reach the ultimate quantum limits imposed by quantum mechanics and the Heisenberg principle and they can be employed in particular in atomic force microscopes and in gravitational wave detectors.

**Invited speaker at the following International conferences**

* 1. “Fluctuations in Physics and Biology: Stochastic Resonance, Signal Processing and Related Phenomena”, Marciana Marina , Isola d’Elba, June 5-10, 1994
  2. “Quantum Computing and Quantum Communications : First NASA International Conference, QCQC '98”, Palm Springs, California, USA, February 17-20, 1998
  3. “Quantum decoherence, information and chaos", Heron Island, Australia, September 21-25, 1998
  4. “III Adriatico Research Conference on Quantum Interferometry”. ICTP Trieste, March, 1-5, 1999
  5. “6th International Conference on Squeezed States and Uncertainty Relations”, Napoli, May 24-29, 1999.
  6. “Entanglement and decoherence”, Gargnano (BS), September 20-25, 1999.
  7. “Macroscopic Quantum Coherence and Quantum Computing”, Napoli, June 14-17, 2000
  8. “5th International Conference on Quantum Communication, Measurement and Computing”, Capri (NA), July 3-8, 2000.
  9. “Mysteries, Puzzles and Paradoxes in Quantum Mechanics”, Gargnano (BS), September 17-23, 2000
  10. “Mysteries, Puzzles and Paradoxes in Quantum Mechanics”, Gargnano (BS), August 27 – September 1, 2001
  11. “International Conference on Experimental Implementations of Quantum Computation”, Sydney, Australia, January 16-19, 2001
  12. “Quantum Information Theory Workshop”, Gold Coast, Australia, January 21-25, 2001
  13. “Cooling 2002”, Visby, Svezia, June 8-13, 2002
  14. “INFM Meeting”, Bari, June 24-28, 2002
  15. “8th International Conference on Squeezed States and Uncertainty Relations”, Puebla, Messico, June 9-13, 2003.
  16. “International Conference Physics and Control 2003”, Saint Petersburg, Russia, August 20-24, 2003.
  17. “Mysteries, Puzzles and Paradoxes in Quantum Mechanics”, Gargnano (BS), September 1-5, 2003
  18. “Advances in Foundations of Quantum Mechanics and Quantum Information with atoms and photons”, Torino, April 26-28, 2004,
  19. “Quantum mechanics and quantum computation”, IIASS "E.R. Caianiello", Vietri sul Mare, March 18-20, 2005.
  20. “Workshop on Theory and Technology in Quantum Information, Communication, Computation and Cryptography”, ICTP Trieste, June 19-23, 2006.
  21. “Laser Physics”, Losanna, July 24-28, 2006
  22. “National Congress of the Italian Society of Physics” 2006, Torino September 18-23, 2006
  23. “European Conference on Lasers and Electro-Optics and the International Quantum Electronics Conference (CLEO®/Europe-IQEC)”, Munich, June 17-22, 2007
  24. “3rd International IEEE Scientific Conference on Physics and Control (PhysCon 2007)”, Potsdam, September 3-7, 2007
  25. “Advances in Foundations of Quantum Mechanics and Quantum Information with atoms and photons”, Torino, May 19-23, 2008
  26. “Quantum/Classical Control in Quantum Information”, Otranto, September 13-20, 2008.
  27. “Open Quantum Systems: Decoherence and Control”, Harvard University, Cambridge, MA (USA), November 20-22, 2008.
  28. “Cavity Cooling of atoms, molecules and ions”, Obergurgl, Tirol, Austria, February 4-8, 2009.
  29. “International Conference on Scalable Quantum Computing with Light and Atoms”, Cortina d’Ampezzo (BL), February 15-22, 2009
  30. “Quantum Control Theory: Probabilistic and Geometrical Aspects”, Padova, 28-29 September 2009
  31. “QuantumComm 2009: International Conference on Quantum Communication and Quantum Networking”, October 26 – 30, 2009 Vico Equense, Italy
  32. “10th International Conference on Quantum Communication, Measurement and Computing”, Brisbane, QLD, Australia, July 19-23, 2010
  33. ICTP Workshop on “Nano-Opto-Electro-Mechanical Systems Approaching the Quantum Regime”, Sept. 6-10, 2010, Trieste
  34. “Congresso Nazionale Società Nazionale di Fisica 2011, L’Aquila 26-30 settembre 2011
  35. “Advances in Foundations of Quantum Mechanics and Quantum Information with atoms and photons”, Torino, 21-25 Maggio 2012
  36. “International School of Physics and Technology of Matter”, Otranto 16-22 Settembre 2012
  37. “Quantum Science Symposium” Cambidge, Regno Unito, 1-2 Novembre-2012
  38. “Quantum Optics VI”, Piriápolis, Uruguay, 12-16, Novembre 2012.
  39. “Frontiers of Nanomechanics”, ICTP Workshop, Sept. 9-13 2013, Trieste
  40. “FisMat 2013 - Italian National Conference on Condensed Matter Physics”, Sept. 9-13 2013, Milano
  41. “iQIT- Integrated Quantum Information Technology”, Sept. 23-27 2013, Corfù (Grecia)
  42. “Cavity Optomechanics - from the micro- to the macro scale”, Nov 4-6 2013, Innsbruck (Austria).
  43. “Advances in Foundations of Quantum Mechanics and Quantum Information with atoms and photons”, May 26-30 2014, Torino
  44. “iQIS2014-7th Italian Quantum Information Science Conference”, Sept. 15-19 2014, Salerno
  45. “QThYES2014 – Quantum Technologies – Hybrid Emitter Solid State Systems”, Sept 21-24 2014, Strasbourg (France)
  46. “Frontiers of Quantum and Mesoscopic Thermodynamics”, 27 July - 1 August 2015, Prague, (Czech Republic)
  47. “Quantum Control of Levitated Optomechanics”, 19-20 May 2016, Pontremoli (Italy)
  48. “Testing Quantum Gravity”, 27-28 May 2016, Turin (Italy)
  49. “Quantum Technologies in Space”, 27-30 March 2017, Valletta (Malta)
  50. "Quantum 2017" 7-13 May 2017, Turin (Italy).
  51. “iQIS2017-10th Italian Quantum Information Science Conference”, Sept. 12-15 2017, Firenze
  52. "Foundations and Applications of Nanomechanics", 25-29 Sept. 2017, ICTP Trieste (Italia)
  53. "Frontiers of Circuit QED and Optomechanics (FCQO 2018)", Feb. 12-14 2018, Klosterneuburg, Austria
  54. "Marcel Grossmann Meeting, MGXV", July 1-7 2018, Roma, Italy
  55. “iQIS2018-11th Italian Quantum Information Science Conference”, Sept. 17-20 2018, Catania
  56. FISMAT 2019 ", National Conference of Physics of Matter, 2019, Sept 30-Oct. 4 2019, Catania
  57. “Congresso Nazionale Società Nazionale di Fisica 2020, Milan, September 14-18, 2020
  58. "IEEE Radar Conference 2020", Florence, September 21-26, 2020

**Patents**

Inventor (in collaboration) of the European Patent "QUANTUM SIGNALS RECEIVER WITH NOISE COMPENSATION, QUANTUM CRYPTOGRAPHY COMMUNICATIONS SYSTEM AND METHOD" n. WO/2011/033543

**Publications in International journals with referees**

[1] D. Vitali, P. Grigolini, “Subdynamics, Fokker-Planck equation and exponential decay of relaxation processes”, Phys. Rev. A **39**, 1486-1499, (1989) .

[2] G. Cicogna, D. Vitali, “Generalised symmetries of Fokker-Planck-type equations”, J. Phys. A: Math. Gen. **22**, L453-L456, (1989).

[3] G. Cicogna, D. Vitali, “Classification of the extended symmetries of Fokker-Planck equations”, J. Phys. A: Math. Gen. **23**, L85-L88, (1990).

[4] P. Grigolini, R. Mannella, R. Roncaglia, D. Vitali, “Quantum mechanical dissipation: from the weak to the strong-coupling limit”, Phys. Rev. A **41**, 6625-6634 (1990).

[5] L. Bonci, P. Grigolini, D. Vitali, “Beyond the semiclassical approximation of the discrete nonlinear Schrödinger equation: collapses and revivals as a sign of quantum fluctuations”, Phys. Rev. A **42**, 4452-4461 (1990).

[6] D. Vitali, P. Grigolini, “Nonlinear effects in quantum dissipation”, Phys. Rev. A **42**, 7091-7106 (1990).

[7] L. Bonci, P. Grigolini, R. Mannella, G. Trefan, D. Vitali, “Statistical mechanics of a nonlinear relaxation process: I. Equilibrium properties”, Phys. Rev. A **43**, 2624-2631 (1991).

[8] L. Bonci, P. Grigolini, R. Mannella, D. Vitali, “Statistical mechanics of a nonlinear relaxation process: II. Dynamical properties”, Phys. Rev. A **44**, 876-883 (1991) .

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[11] L. Bonci, R. Roncaglia, D. Vitali, B.J. West, P. Grigolini, “Irreversibility and quantum macroscopic effects of classically chaotic systems”, Int. J. Mod. Phys. B **7**, 1175-1205 (1993).

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[13] D. Vitali, P. Allegrini, P. Grigolini, “Nonlinear quantum mechanical effects: real or artefact of inaccurate approximation?”, Chem. Phys. **180**, 297-318 (1994).

[14] D. Vitali, L. Tessieri, P. Grigolini, "Wave-function collapse and quantum fluctuation-dissipation process", Phys. Rev. A **50**, 967-976 (1994).

[15] P. Tombesi, D. Vitali, "Physical realization of an environment with squeezed quantum fluctuations via QND-mediated feedback", Phys. Rev. A **50**, 4253-4257 (1994).

[16] P. Allegrini, L. Bonci, P. Grigolini, R. Mannella, R. Roncaglia, D. Vitali, "Comment on 'Quantum chaos in the Born-Oppenheimer approximation'", Phys. Rev. Lett. **74**, 1484 (1995).

[17] D. Vitali, "Proton tunneling in symmetric H-bond: a simple microscopic model", Chem. Phys. **192**, 79-88 (1995).

[18] P. Tombesi, D. Vitali, "Optical feedback from quantum non-demolition measurements: How to realize a measurement apparatus to observe macroscopic quantum coherence", Appl. Phys. **B60**, S69-S75 (1995).

[19] L. Tessieri, D. Vitali, P. Grigolini, "Quantum jump as an objective process of nature", Phys. Rev. A. **51**, 4404-4414 (1995).

[20] P. Tombesi, D. Vitali, "Macroscopic coherence via quantum feedback", Phys. Rev. A. **51**, 4913-4917 (1995)

[21] D. Vitali, R. Mannella, "Quantum stochastic resonance in the dissipative two-state system", Nuovo Cimento **17D**, 959-967 (1995).

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[29] D. Vitali, P. Tombesi, G.J. Milburn, "Protecting Schrödinger cat states using feedback", J. Mod. Opt. **44**, 2033-2041 (1997).

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[31] D. Vitali, P. Tombesi, G.J. Milburn, "Quantum state protection in cavities", Phys. Rev. A **57**, 4930-4944 (1998).

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Phys. Rev. A **69**, 029901(E) (2004).

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[60] D. Vitali, “Decoupling methods for heating and decoherence control”, J. Opt. B: Quantum Semiclass. Opt. **4**, S337–S344 (2002).

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