Curriculum vitae of Marco Roncaglia

Curriculum vitae:

- March 1993: Doctor in Physics (*Laurea*) at the University of Bologna with the final mark of 110/110 *cum laude*.
- November 1993-May 1998: Ph.D. at the University of Bologna, under the supervision of Prof. G. Morandi. Title of the thesis: *Study of the phase diagram of the t-J model*.
- May 1994-May 1995: Military service.
- June 1998-May 1999: Post-doc at the Consejo Superior de Investigacion Cientifica (CSIC) in Madrid for one year under the supervision of Prof. G. Sierra.
- July 1999-June 2001: Post-doc fellowship at the University of Bologna.
- July 2001-October 2001: Post-doc fellowship at the University of Bologna.
- October 2001-September 2003: Research fellow (assegno di ricerca) for a project entitled: *Strongly correlated spin and electronic systems. A study of effective theories and approximation methods*.
- October 2003-October 2004: Post-doc at the University of Bologna.
- November 2004-October 2006: Research fellow (assegno di ricerca) for a project entitled: *Methods and field theories for the study of strongly correlated quantum systems.*
- November 2006-October 2007: Research fellow (assegno di ricerca) for a project entitled: *Strongly correlated spin and electronic systems.*
- October 2007-July 2009: Research fellowship (Wissenschaft Mitarbeiter) at the Max-Planck-Institut für Quantenoptik (MPQ), Garching, Germany.
- August 2009-July 2010: Research Scientist at Institute for Scientific Interchange (ISI) Torino Italy.
- August 2010-July 2011: Research Collaborator in the Theory group at Dipartimento di Fisica del Politecnico di Torino, Italy.
- November 2010-December 2010: Visiting Fellow in the group of Prof. U. Schollwöck, Arnold Sommerfeld Center at LMU Munich, Germany.
- October 2011-April 2013: Research fellow (assegno di ricerca) at Politecnico di Torino.
- May 2013 - April 2015: Researcher at the INRIM Institute, Torino.
- June 2015 - December 2015: Research fellow (assegno di ricerca) at Politecnico di Torino.
- Sept. 2015 - Aug 2017: Professor of Mathematics at “Albe Steiner” Institute, Turin.
- Sept. 2017 -: Professor of Mathematics (permanent position) at IPSIA “G. Ferraris” Institute, Settimo Torinese (TO).
- August 2017: Visiting fellow at the Technische Universität Kaiserslautern, department of Physics.

Habilitations:

- Italian habilitation to teach Theoretical Condensed Matter Physics in the University as an Associate Professor (Bando D.D. 1532/2016 - 02/B2 - Fisica teorica della materia - Fascia II)
- Italian habilitation to teach Mathematics in the High School (Concorso D.D.G. 82/2012 - Classe A047 - Matematica)

Teaching (university courses):

- **2006/2007:** Lectures on “Mathematical Analysis” (1st year - Department of Informatics, Bologna)
- **2006/2007:** Lectures on “Many-body physics” and “Quantum theory of matter” (4th year - Department of Physics, Bologna)
- **2006/2007:** Mini course on “BCS Theory of Superconductivity” (4th year - Department of Physics, Bologna)
- **2006/2007:** Mini course on “Introduction to Quantum Information” (3rd - 4th year - Department of Physics, Bologna)
- **2011/2012:** Lectures on “Calculus” (1st year - Department of Architecture, Torino)
- **2006/2007:** Lectures on “Mathematical methods for urban projects” (3rd year - Department of Architecture, Torino)
- **2012/2013:** Master course on “Solid State Physics” (4th year - Politecnico, Torino)
- **2013/2014:** Master course on “Quantum Solid State Physics” (4th year - Politecnico, Torino)
- **2012/2013:** Lectures on “Physics 2 (electrodynamics)” (2nd year - Politecnico, Torino)
- **2013/2014:** Lectures on “Physics 2 (electrodynamics)” (2nd year - Politecnico, Torino)

Participation to EU Projects:

- TMR EUCLID: Integrable models and applications: from strings to condensed matter (contract no: HPRN-CT-2002-00325) [Oct. 2002 – Oct. 2006]
- SCALA, Scalable quantum computing with light and atoms. (Garching, WP4.2/MPQ.TH) [Dec. 2005 – Dec. 2009]
- HIP, Hybrid Information Processing (no. 221889), FP7 EU-STREP. [Nov. 2008 - Oct. 2011]
- COQUIT, Collective Quantum Operations for Information Technology (no. 233747), FP7 EU-STREP. [May 2009 - Apr. 2012]
- IQIT, Integrated Quantum Information Technology (no. 270843), FP7 EU-STREP. [Oct. 2011 - Sep. 2014]
- OPTINF, EU-ERC project (no. 267915).
- Italian project financed by *Compagnia di San Paolo*, (Torino). Title: *Oltre i limiti classici della misura sfruttando le correlazioni quantistiche.*

Theses:
The fellow has contributed to the supervision of several degree and PhD theses at University of Bologna, Politecnico of Torino and INRIM:
Dr. L. Campos Venuti, Dr. L. Pisani, Dr. F. Anfuso, Dr. L. Chirolli, Dr. A. Scaramucci, Dr. E. Canovi, Dr. A. Droghetti, Dr. M. Dalmonte, Dr. S. Pasini, Dr. M. Didio, Dr. L. Barbiero, Dr. D. Canuto, Dr. F. Gentile, Dr. S. Fazzini.

Referrals:
He is referee for the APS journals: *Phys. Rev. Lett.*, *Phys. Rev. A* and *B*.
He is referee for the IOP journal: *Phys. Jou. A*.
He is referee for the WS journal: *Int. J. Quantum Inf.*
He is referee for the NPG journal: *Nature Physics.*

Translations of textbooks (from English to Italian):
- *Statistical Mechanics,* K. Huang
- *Physical Chemistry,* D. McQuarrie and J.D. Simon.

Research experience

The fellow earned his degree at the University of Bologna in March 1993 under the supervision of Prof. E. Remiddi, with a thesis about the study of electronic correlations in atomic systems. Final mark: 110/110 *cum laude*.

With the PhD, the applicant began his activity in the field of theoretical Condensed Matter, specifically in the branch of spin and electronic strongly correlated systems in low dimensions. He studied the finite temperature phase diagram of the *t-J* model in two dimensions with and without the inclusion of the three-site hopping term, which comes out from the *t*/*U* expansion of the Hubbard model. This research focused mainly on the emergence of phase separation.
During the PhD, the fellow started to orient his interests toward quasi one-dimensional spin systems, such as AFM Heisenberg chains and ladders. Such activity can be appreciated from the paper in Ref. [2] that extends the “Haldane conjecture” to spin ladders.
In the course of his PhD, he became familiar with mean-field methods, mapping onto effective field theories, many-body physics, non linear σ-models, discrete integrable models, and some numerical techniques. The PhD finished in 1998, five years after his degree instead of three years, due to a short break for military-service duties (1 year) and because he gave lectures of Informatics for a private institution (nearly 1 year).

The first post-doc experience was in Spain at the CSIC, under the supervision of Prof. G. Sierra. He studied the properties of spin ladders in presence of

magnetic field (both uniform and staggered). Using a variational Ansatz for resonating valence bonds (RVB), the fellow illustrated the role of the resonances between various local configurations within the 4-leg ladder, obtaining appreciable quantitative results [4]. During the post-doc in Spain, he learned several types of theoretical methods: Holstein-Primakoff, hard-core bosons, recurrent-RVB approaches, matrix-product states, renormalization group. In support of the analytical results, he made use of numerical techniques such as DMRG and Lanczos diagonalization.

In the middle of 1999 the experienced researcher went back to Bologna, beginning a relatively long experience as a member of the research group of Prof. G. Morandi, where the activity was basically devoted to the study of spin-1 chains in staggered magnetic field or with the inclusion of anisotropies. The group studied mainly the magnetic properties and the spectral weight of excitations. In particular, the fellow obtained a non linear σ-model description in excellent accordance with numerical data [7]. Moreover, by means of a simple but effective way of including 3D effects, he was able to provide an explication of the experimental data from neutron scattering on $CsNiCl_3$ where other theories failed [11].
In the meantime, the applicant continued his collaboration with the group of Prof. G. Sierra, making several visits in Madrid. By extending the method of generating 1D matrix product states to tensor product states in 2D, he has studied a family of ground states (related to vertex models in statistical mechanics), which are suggestive of stripe phases in high-T_c superconductors [8]. Such paper has been later rediscovered by the quantum-information community working in tensor-product related methods (like PEPS and MERA) that have been conceived afterward.
The investigation of critical phases in spin-1 chains [12], gave the fellow the opportunity to learn powerful theoretical methods, like conformal field theories, bosonization and mapping onto integrable systems. An new conjecture on the renormalization flux of the non linear σ-model with nontrivial topological term have been proposed in Ref. [13].

The end of 2004 coincides with the fellow's decision to pursue his research as an independent scientist. Starting from 2005 to the end of 2007, the applicant coordinated a small group of 3 young researches investigating measures and characterization of entanglement in low-dimensional systems. First, the group have found a strict relation between the recently introduced concept of localized entanglement and correlation functions in a large class of 1D systems [14]. Then, they have derived in general the critical properties of all the local measures of entanglement [15]. The most important work in such period concerns the introduction of the concept of *long-distance entanglement* (LDE), according to which in some systems two selected particles can be entangled even if they are infinitely far apart and the interactions are short-ranged [16]. The LDE phenomenon takes place in several common spin models, with interesting consequences for both the fields of condensed matter and quantum information. Later, the LDE properties of antiferromagnetic chains have been exploited for demonstrating the possibility of performing

both *teleportation* and *transmission* of qubits, which are robust against the detrimental effects of temperature [18].
A more technical work has been published [19] on a novel method for the detection of quantum critical points from numerical data. It allows a quicker convergence than other previously known methods. Moreover, it turns out to be applicable to the detection of the Berezinkii-Kosterlitz-Thouless (BKT) transition, typically hard to recognize. The last work within the group of Bologna concerns [20] the use of nonlocal transformations for the study of string order in 1D spin systems and for unveiling hidden symmetries. Duties at the Department of Physics in Bologna included teaching activity and periodical reporting of progress in our investigation. On top of that, the fellow have been following young students in proposing timely research ideas, making calculations and correcting their thesis.

In October 2007, the fellow joined the theory group at the Max-Planck Institut für Quantenoptik (MPQ, Garching, Germany) directed by Prof. I. Cirac. This marked another turning point in the scientific career of the experienced researcher: its interests extended to the physics of trapped ultracold atoms. One of the research activities concerns quantum simulations of fractional quantum Hall effect (FQHE) in atomic traps loaded with bosonic atoms.
Together with I. Cirac and M. Rizzi the researcher proposed [22] a filtering mechanism that exploits strong 3-body dissipation for preparing and detecting the so-called Pfaffian state, which plays an important role in protocols of topological quantum computation.
The FQHE has not been observed so far in experiments, due to some problems related to the difficulty of injecting angular momentum into the system. In order to circumvent this problem, he has established a fruitful collaboration with Prof. J. Dalibard (ENS, Paris) for using adiabatic trap deformation and exploiting the properties of non-harmonic potentials for preparing the system in an initial controllable phase [26].

The fellow has studied the possibility of simulating a chain of interacting anyons hopping between nearest neighbor sites of an optical lattice. A theoretical work [25] about the anyon-Hubbard model has been published n Nature Communications with researchers in the group of Prof. U. Schollwöck at the Ludwig-Maximilian Universität in Munich, Germany.

In 2009, the fellow decided to come back to Italy. In Sept. 2009 he joined the Institute of Scientific Interchange (Torino, Italy). The contract was under the HIP (Hybrid Information Processing) EU-Project through Prof. F. Illuminati, from University of Salerno. The project focused on quantum information processes in condensed matter and optical systems. Later, the researcher gave a decisive contribution to the preparation of the proposal for the IQIT (Integrated Quantum Information Technology) EU-Project. A mathematical work [23] demonstrates the equivalence between the quantum XY model and the XX dimerized model. Such equivalence implies a non-local unitary transformation that unveils hidden symmetries and end-to-end quantum correlations of both systems.

Since Sept. 2010 the researcher has been part of the theory group of the Physics Department inside the Politecnico in Torino. In collaboration with Prof. A. Montorsi he has found that the fermionic Hubbard model with correlated hopping can be effectively mapped onto the integrable XY model in transverse field [24]. Consequently, several properties of the parent model have been derived and compared with numerical data, obtaining excellent accordance. In particular the authors were able to find for the first time an analytic form for the phase boundaries of the superconducting phase. Extensions of such theory to 2D systems are under consideration, due to their relevance in the field of high-T_c superconductivity. In 1D we have studied nonlocal order parameters in the well-celebrated Hubbard model, finding that a couple of them (the charge or spin parity of a string) are non-vanishing asymptotically, thus representing genuine order parameters for the Mott-insulating and the Luther-Emery phases, respectively [27,28].

In parallel, we have investigated a reliable measure of bipartite entanglement for a restricted Hilbert space in arbitrary dimension [29]. Such a space, which has the property that every state can be written in the same factorized Schmidt basis, is relevant for several applications including bosons in double wells [30] and strongly correlated fermionic systems. Entanglement properties have also been investigated between a dimer model relevant in the mechanism of light harvesting in living organisms and its environment [32].

A collaboration with external physicists has been activated for the study of FQHE states with ultracold fermions in presence of an artificial non-Abelian gauge field. This has been obtained through the inclusion of spin-orbit terms in the Hamiltonian. This fact causes a deformation of Landau levels and a non monotonic behavior of Haldane pseudopotentials, which give rise to interesting quantum many-body states [31].

Another recent collaboration concerns the investigation of integrability in 2D formionic models with arbitrary angular momentum pairing [36].

As an independent scientist, he is interested in foundations of quantum mechanics from the perspective of quantum information. Very recently, an important general work on the conservation of information in quantum physics has been published on the ArXiv [35].

Publications:

[1] E. Ercolessi, P. Pieri, M. Roncaglia,
A new phase diagram for the t-J model,
Phys. Lett. A **225**, 331 (1997). [10.1016/S0375-9601(96)00895-X]

[2] S. Dell'Aringa, E. Ercolessi, G. Morandi, P. Pieri and M. Roncaglia,
Effective actions for spin ladders,

Phys. Rev. Lett. **78**, 2457 (1997). [10.1103/PhysRevLett.78.2457]

[3] E. Ercolessi, P. Pieri, M. Roncaglia,
Phase separation and three-site hopping in the 2-dimensional t-J model,
Phys. Lett. A **233**, 451 (1997). [10.1016/S0375-9601(97)00464-7]

[4] M. Roncaglia, G. Sierra, M. A. Martin-Delgado,
Dimer-resonating valence bond state of the four-leg Heisenberg ladder: Interference among resonances,
Phys. Rev. B **60**, 12134 (1999). [10.1103/PhysRevB.60.12134]

[5] E. Ercolessi, G. Morandi, L. Pisani and M. Roncaglia,
Mixed Phases for the t-J Model,
Physica C **331**, 178 (2000). [10.1016/S0921-4534(99)00672-3]

[6] E. Ercolessi, G. Morandi, P. Pieri and M. Roncaglia,
Integer-spin Heisenberg Chains in a Staggered Magnetic Field. A Nonlinear Sigma-Model Approach,
Europhys. Lett. **52**(4), 434 (2000). [10.1209/epl/i2000-00456-2]

[7] E. Ercolessi, G. Morandi, P. Pieri and M. Roncaglia,
Spin-1 Antiferromagnetic Heisenberg Chains in an External Staggered Field,
Phys. Rev. B **62**, 14860 (2000). [10.1103/PhysRevB.62.14860]

[8] M.A. Martin-Delgado, M. Roncaglia, G. Sierra,
Stripe Ansätze from Exactly Solved Models,
Phys. Rev. B **64**, 075117 (2001). [10.1103/PhysRevB.64.075117]

[9] L. Campos Venuti, E. Ercolessi, G. Morandi, P. Pieri and M. Roncaglia,
Heisenberg Integer Spin Chains in a Uniform Magnetic Field,
Int. J. Mod. Phys. B **16**, 1363 (2002). [10.1142/S0217979202010099]

[10] F. Anfuso, E. Ercolessi, G. Morandi and M. Roncaglia,
Effect of a Staggered Magnetic Field on the S=1 Haldane Chain with Single-ion Anisotropy,
Phys. Lett. A **302**, 48 (2002). [10.1016/S0375-9601(02)01054-X]

[11] E. Ercolessi, G. Morandi, M. Roncaglia,
Multiparticle Continuum in the Excitation Spectrum of the S=1 Compound $CsNiCl_3$",
Eur. Phys. J. B **32**, 489 (2003). [10.1140/epjb/e2003-00129-0]

[12] C. Degli Esposti Boschi, E. Ercolessi, F. Ortolani, M. Roncaglia,
On c=1 Critical Phases in Anisotropic Spin-1 Chains,
Eur. Phys. J. B **35**, 465 (2003). [10.1140/epjb/e2003-00299-7]

[13] L. Campos Venuti, C. Degli Esposti Boschi, E. Ercolessi, F. Ortolani, G. Morandi, S. Pasini and M. Roncaglia,
Particle content of the nonlinear sigma model with a q-term: a lattice model investigation,
J. Stat. Mech. L02004 (2005). [10.1088/1742-5468/2005/02/L02004]

[14] L. Campos Venuti and M. Roncaglia,
Analytic Relations between Localizable Entanglement and String Correlations in Spin Systems,
Phys. Rev. Lett. **94,** 207207 (2005). [10.1103/PhysRevLett.94.207207]

[15] L. Campos Venuti, C. Degli Esposti Boschi, M. Roncaglia, A. Scaramucci,
Local Measures of Entanglement and Critical Exponents at Quantum Phase Transitions,
Phys. Rev. A **73,** 010303 (2006). [10.1103/PhysRevA.73.010303]

[16] L.Campos Venuti, C. Degli Esposti Boschi, M. Roncaglia,
Long-Distance Entanglement in Spin Systems,

Phys. Rev. Lett. **96**, 247206 (2006). [10.1103/PhysRevLett.96.247206]

[17] L.Campos Venuti, C. Degli Esposti Boschi, E. Ercolessi, G. Morandi, F. Ortolani, S. Pasini and M. Roncaglia,
Stable particles in anisotropic spin-1 chains,
Eur. Phys. J. B **53**, 11 (2006). [10.1140/epjb/e2006-00342-3]

[18] L.Campos Venuti, C. Degli Esposti Boschi, M. Roncaglia,
Qubit Teleportation and Transfer across Antiferromagnetic Spin Chains,
Phys. Rev. Lett. **99**, 060401 (2007). [10.1103/PhysRevLett.99.060401]

[19] M. Roncaglia, L.Campos Venuti, C. Degli Esposti Boschi,
Rapidly converging methods for the location of quantum critical points from finite-size data,
Phys. Rev. B **77**, 155413 (2008). [10.1103/PhysRevB.77.155413]

[20] C. Degli Esposti Boschi, M. Di Dio, G. Morandi, M. Roncaglia,
Effective Mapping of Spin-1 onto Integrable Fermionic Models. A Study of String and Néel Correlation Functions",
J. Phys. A: Math. Theor. 42 (2009) 055002. [10.1088/1751-8113/42/5/055002]

[21] M. Roncaglia, M. Rizzi, J.I. Cirac,
Pfaffian State Generation by Strong Three-Body Dissipation,
Phys. Rev. Lett. **104**, 096803 (2010). [10.1103/PhysRevLett.104.096803]

[22] L. Campos Venuti, M. Roncaglia,
Equivalence between XY and dimerized models,
Phys. Rev. A **81**, 060101(R) (2010).[10.1103/PhysRevA.81.060101]

[23] Marco Roncaglia, Cristian Degli Esposti Boschi and Arianna Montorsi, *Hidden XY structure of the bond-charge Hubbard model*,
Phys. Rev. B **82**, 233105 (2010). [10.1103/PhysRevB.82.233105]

[24] Tassilo Keilmann, Simon Lanzmich, Ian McCulloch and Marco Roncaglia
Statistically induced Phase Transitions and Anyons in 1D Optical Lattices,
Nature Comm. **2**, 361 (2011). [10.1038/ncomms1353]

[25] Marco Roncaglia, Matteo Rizzi and Jean Dalibard,
From Rotating Atomic Rings to Quantum Hall States,
Scientific Reports **1**, 43 (2011). [10.1038/srep00043]

[26] Arianna Montorsi and Marco Roncaglia,
Nonlocal order parameters for the 1D Hubbard model,
Phys. Rev. Lett. **109**, 236404 (2012). [10.1103/PhysRevLett.109.236404]

[27] Luca Barbiero, Arianna Montorsi and Marco Roncaglia,
How Hidden Orders Generate Gaps in 1D Fermionic Systems,
Phys. Rev. B **88**, 035109 (2013). [10.1103/PhysRevB.88.035109]

[28] Marco Roncaglia, Arianna Montorsi and Marco Genovese,
Bipartite entanglement of quantum states in a pair basis,
Phys. Rev. A **90**, 062303 (2014). [10.1103/PhysRevA.90.062303]

[29] Fabio Gentile, Arianna Montorsi and Marco Roncaglia,
Entanglement Generation and Dynamics for a Bose-Hubbard Model in a Double-Well Potential, Int. Jou. Quant. Inf. **12**, 1560014 (2015). [10.1142/S021974991560014X]

[30] Michele Burrello, Matteo Rizzi, Marco Roncaglia, Andrea Trombettoni,
Strongly correlated states of trapped ultracold fermions in deformed Landau levels,
Phys. Rev. B **91**, 115117 (2015) [10.1103/PhysRevB.91.115117].

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Finding the critical point using improved scaling Ansaetze,
J. Stat. Mech. P04005 (2015). [10.1088/1742-5468/2015/04/P04005]

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Quantum correlation dynamics in photosynthetic processes assisted by molecular vibrations,
Ann. Phys. **361**, 72 (2015). [10.1016/j.aop.2015.06.002]

[33] Cristian Degli Esposti Boschi, Arianna Montorsi and Marco Roncaglia,
Brane parity orders in the insulating state of Hubbard ladders,
Phys. Rev. B **94**, 085119 (2016). [10.1103/PhysRevB.94.085119].

[34] Serena Fazzini, Arianna Montorsi, Marco Roncaglia and Luca Barbiero,
Hidden Magnetism in Periodically Modulated One Dimensional Dipolar Fermions,
New J. Phys. **19**, 123008 (2017). [10.1088/1367-2630/aa9037]

[35] Luca Lepori, Marco Roncaglia,
Solvable 2D Superconductors with l-wave Pairing,
Phys. Rev. B **98**, 144504 (2018). [*10.1103/PhysRevB.98.144504*]

[36] Marco Roncaglia,
On the Conservation of Information in Quantum Physics,
arXiv:1708.05727. [*arXiv:1708.05727*]

Main research results:

- First proof of the “Haldane conjecture” was given for spin ladders, using a mapping onto a continuum field theory called *non linear σ-model with topological term* [2]. In the 80’s Haldane conjectured that integer (half-integer) spin chains are gapped (gapless). It has been shown that half-integer spin ladders are gapless for an odd number of legs; all the other cases yield to a gap in the excitation spectrum above the ground state. The conjecture has been confirmed both numerically and experimentally.

- The new concept of *long distance entanglement* (LDE) was introduced in [16], as a *genuinely quantum* order parameter. The fellow discovered that, even in presence of short-ranged interactions, entanglement can be generated between two distant particles in the ground state of some (spin) models. Due to some important consequences in condensed matter and quantum information, some groups in England, Portugal, Italy and China adopted LDE as a subject for their investigations.

- Proposal to use three-body dissipation in rotating traps with bosonic atoms for preparing the Pfaffian state at filling factor ν = 1 [22]. Typically, three-body recombination processes are unwanted since they cause particle losses from the trap. However, in this case they provide a filtering mechanism that induce the right correlations that characterize the Pfaffian. Such quantum state plays an important role in topological quantum computation.

- A new optical scheme has been proposed for the quantum simulation of interacting anyons in 1D [24]. The method is based on the statistical transmutation of bosonic atoms into anyons by means of a density-dependent gauge field. The new resulting anyon-Hubbard model has been shown to display a Mott-superfluid transition by varying the statistics of particles. The idea has later been adopted by several research groups in the EU.

- An entropic measure has been introduced for quantifying the informational content of quantum states, which turns out to be the information which is conveyed from past to future measurements. This quantity is essential for writing equations describing how the information in time is transformed into mutual information between different systems, conserving the total amount. Moreover, it has been studied the amount of information locally achievable, ending up to a new measure of nonlocal correlations (similar to the discord, but more symmetric). The present study proposes a different "vision" with respect to the mainstream, which not only establishes a new interpretative perspective, but it may also be crucial for shedding light on some unsolved problems in physics, like, for instance, the so-called black-hole information paradox [35].

Invited talks at conferences:

- *Integrable Models and Applications.* Firenze, Italy. 15-20 September 2003. Contribution: *Spin-1 Chains: Critical Properties and CFT.*
- *Quantum Mechanics and Quantum Information.* Lecce, Italy. 6-8 Mag. 2005. Contribution: *Entanglement and Correlation Functions in Low-Dimensional Systems.*
- *TOPQIP Meeting.* ISI, Villa Gualino, Torino, Italy. 18-22 July *2005.* Contribution: *Entanglement in Low-Dimensional Systems.*
- *Open Systems & Quantum Information.* Dipartimento di Fisica, Milano, Italy.10 March 2006. Contribution: *Measures of Entanglement at Quantum Phase Transitions.*
- *Quantum Mechanics Meeting.* Bertinoro (FC), Italy. 3-8 December 2007. Contribution: *Spin Chains as Quantum Channels.*
- *Max Planck Society Theory Group Meeting 2007*. Ringberg Castle, Germany. 9-12 December 2007. Contribution*: A tutorial on Quantum Phase transitions.*
- *MATHQCI 2008. International Workshop on the Mathematical Foundations of Quantum Control and Quantum Information Theory*. Madrid, Spain. 25-30 May 2008**.** Contribution*: Spin Chains as Quantum Channels.*
- *Max Planck Society Theory Group Meeting 2008*. Kirchberg, Austria. 5-8 June 2008**.** Contribution*: Quantum Hall Effect in Rotating Traps.*

- *Quantum Technologies Conference. Torun, Poland*. 29 August - 3 September 2010. Contribution: *Adiabatic Trap Deformation for Preparing Quantum Hall States.*
- *XVI Convegno Nazionale di Fisica Statistica e dei Sistemi Complessi*, Parma, Italy. 22-24 June 2011. Contribution: *The hidden XY structure of the Hubbard model with correlated hopping.*
- *International School on Anyon Physics of Ultracold Atomic Gases,* Freie Universität, Berlin, Germany. 24-28 September 2013. Contribution: *Anyons in one dimension* (2 lectures of 1h).
- *Advances in Foundations of Quantum Mechanics and Quantum Information with Atoms and Photons*, INRIM, Turin, Italy. 25-30 May 2014. Contribution: *Bipartite Entanglement for Quantum States in a Pair Basis.*
- *Quo Vadis BEC?*, Bad Honnef, Germany. 16-20 Dec 2014. (not attended due to the birth of my daughter).
- Quantum 2019. From Foundations of Quantum Mechanics to Quantum Information and Quantum Metrology & Sensing. 26 May - 1 June 2019. Contribution: *On the Conservation of Information in Quantum Physics.*

Visits at Institutes with invitation to give seminars:

- *Max-Planck Institut fuer Quantenoptik.* Garching, Germany. 25-29 September 2006. Contribution*: Long-distance entanglement in low-dimensional systems.*
- *Consejo Superior de Investigaciones Cientificas (CSIC) 2007*. Madrid, Spain. 10 July 2007*.* Contribution: *Qubit Teleportation and Transfer across Spin Chains.*
- *Institute of Scientific Interchange, Torino, Italy.* 2-3 April 2009. Contribution: *Quantum-Hall States in Cold Atomic Rotating Traps with Strong Dissipation.*
- *Institut fuer Quantenoptik und Quanteninformation (IQOQI)*, Innsbruck, Austria. 9-10 June 2009. Contribution: *Quantum-Hall States in Cold Atomic Rotating Traps with Strong Dissipation.*
- *Dipartimento di Fisica, Bologna*, Italy. 6 July 2009. Contribution: *Quantum-Hall States in Cold Atomic Rotating Traps with Strong Dissipation.*
- *Universität des Saarlandes*, Saarbrücken, Germany. 13-16 Dec. 2009. Contribution: *Quantum-Hall States in Cold Atomic Rotating Traps with Strong Dissipation.*
- *Arnold Sommerfeld Center (Ludwig-Maximilians-Universität),* München*, Germany.* 26 Nov 2010. Contribution: *Adiabatic Trap Deformation for Preparing Fractional Quantum-Hall States.*
- *Fachbereich Physik (Technische Universität)*, Kaiserslautern, Germany, 21-25 October 2013. Contribution: *Quantum Simulation of Anyons in One dimension.*
- Institut für Physik, Johannes-Gutenberg-Universität, Mainz, Germany*,* 25-29 November 2013. Contribution: *Quantum Simulation of Anyons in One dimension.*

Poster contributions at conferences:

- *XX Convegno di Fisica Teorica e Struttura della Materia.* Fai della Paganella (TN), Italy. 25-28 March 2001.
- *Advanced Seminar on Field Theoretical Methods in Condensed Matter Physics.* Sant Feliu de Guixols, España. 10-16 June 2001.
- *Theoretical Trends in Low-Dimensional Magnetism, LDM 2003.* Firenze, Italy. 23-25 July 2003.
- *XXII Convegno di Fisica Teorica e Struttura della Materia.* Fai della Paganella (TN), Italy. 20-23 March 2003.
- *XXIII Convegno di Fisica Teorica e Struttura della Materia.* Fai della Paganella (TN), Italy. 18-21 April 2004.
- *Workshop on Quantum Information Theory, (London Mathematical Society).* York, UK. 6-8 July 2005.
- *INSTANS Summer Conference.* Villa Olmo, Como, Italy. 12-16 June 2006.
- *ICTP Workshop on Quantum Information.* ICTP, Trieste, Italy. 19-23 June 2006.
- *CFT and Integrable Models.* Dipartimento di Fisica, Bologna, Italy. 5-8 July 2006
- *Quantum Mechanics: from Fundamental Problems to Applications.* Bertinoro (FC), Italy.4-7 December 2006.
- *Quantum Information and Many-Body Quantum Systems.* Pisa, Italy. 26-31 March 2007.
- *International Conference on Scalable Quantum Computing with Light and Atoms.* Cortina D'Ampezzo, Italy. 15-22 February 2009
- *BEC2009 - Frontiers in Quantum Gases*, Sant Feliu de Guixols, Spain. 5-11 Sept. 2009.
- *Quantum Simulators – Physikzentrum at Bad Honnef,* Germany. 12-15 October 2009.
- *Theory of Quantum Gases and Quantum Coherence*, Nice, France. 2-4 June 2010.
- *Workshop on Frontiers in Ultracold Fermi Gases,* Trieste, Italy, 6-10 June 2011.
- *Workshop on Quantum Simulations with Ultracold Atoms, ICTP,* Trieste, Italy, 16-20 July 2012.
- *International School of Physics and Technology*, Otranto, Italy, 16-22 September 2012.
- *Workshop on Ultracold Atoms and Gauge Fields, ICTP,* Trieste, Italy, 13-17 May 2013.
- *BEC2013 - Frontiers in Quantum Gases*, Sant Feliu de Guixols, Spain. 7-13 Sept. 2013.
- *Fundamental Physics with Light and Atoms, INRIM, Turin, Italy, 26-27 Jan. 2015.*