Curriculum vitæ

Name:	**Davide Gabrielli**
Nationality:	Italian
Birthday:	31-10-1967
Marital status:	Married, 2 sons
Languages:	Italian (native language), Portuguese and English (fluent), German and French (basic)
Position:	Associate Professor
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Studies

• 1994: Degree in Physics with full marks and honors, University *La Sapienza*, Roma. The main results of the thesis are published in the reference [44].

• 1998: Ph.D. in Mathematical Physics; *International School for Advanced Studies* SISSA-ISAS, Trieste. The main results of the thesis are published in the references [3], [4], [45].

Appointments

• 1999-2000: Postdoc fellow; *IME Instituto de Matematica e Estatistica*, University of São Paulo

• 2001: Postdoc fellow; Mathematics Department, University of Wien

• 2001: Assistant Professor in Mathematical Physics; Mathematics Department, University of L'Aquila

• 2010: Winner of a competition for associate professorship in Probability and Statistics

• 2013: Associate professor on Probability and Statistics; Mathematics Department, University of L'Aquila

• 2013: Qualification (Italian *Abilitazione*) for full professorship in Mathematical Physics

• 2018: Qualification (Italian *Abilitazione*) for full professorship in Probability and Statistics and in Mathematical Physics

Awards

• 1988: *Enrico Persico* Prize of the *Accademia Nazionale dei Lincei*

• 2013: Tullio Levi Civita Lecture

• Full excellence in the Italian evaluation of research VQR 2004-2010

• Full excellence in the Italian evaluation of research VQR 2011-2014

Scientific interests

Statistical Mechanics, Probability, Stochastic Processes, Interacting Particle Systems, Large Deviations, Information Theory, Graph Theory and Combinatorics, Discrete Geometry and Quantum Gravity.

Conferences

I gave seminars on several institutions and I was an invited speaker at the following international conferences

• 22^o *Colóquio Brasileiro de Matemática*, IMPA, Rio de Janeiro, Brasil, (1999)

• *Dynamical Systems: Classical, Quantum, Stochastic*, Capo Teulada, Italy, (2000)

• *Dynamical Systems: Classical, Quantum and Stochastic*, Otranto, Italy (2002).

• *Dynamics of Regulatory Networks*, Cuernavaca (Mexico) (2003)

• 25^o *Colóquio Brasileiro de Matemática* IMPA, Rio de Janeiro, Brasil (2005).

• *9-th Brazilian School of Probability*, São Sebastião, Brasil, exercises sessions for the course *Large deviation approach to non equilibrium processes in stochastic lattice gases* (2005)

• *Spontaneous Symmetry Breaking in Particle Systems Far From Equilibrium* Oosterend, Terschelling, Holland, (2006)

• *Dynamical Systems: Classical, Quantum and Stochastic*, Roma, Italy, (2006)

• *Inhomgeneous Random Systems*, Paris, France, (2007)

• *Interacting Stochastic Particle Systems* CRM, Montreal, Canada (2009)

• *Large Fluctuations in Non-Equilibrium Systems*, Max-Planck-Institut, Dresden, Germany (2010)

• *Dynamical Gibbs-non-Gibbs transitions*, Eurandom, Eindhoven, Holland, short course (2011)

• *PHENIX Meeting* , IHP Paris, France (2012)

• *Non-equilibrium Statistical Mechanics and the Theory of Extreme Events in Earth Science*, Reading, UK (2013)

• *Random combinatorial structures and statistical mechanics*, Venice (2013)

• *Advances in Nonequilibrium Statistical Mechanics: large deviations and long-range correlations, extreme value statistics, anomalous transport and long-range interactions* Firenze (2014)

• *Large deviations in statistical Physics*, Stellenbousch, South Africa (2014)

• *Statistical mechanics and computation of large deviation rate functions*, Lyon (2015)

• *XX Congresso Unione Matematica Italiana*, Siena, seminar in invited section (2015)

• *Nonequilibrium: Physics, Stochastics and Dynamical Systems* CIRM Marseille, short course (2016)

• *Variational Structures and Large Deviations for Interacting Particle Systems and Partial Differential Equations*, Eurandom Eindhoven, Holland (2016)

• Invited seminar at **College de France**, Paris (2017)

• *Stochastic Dynamics Out of Equilibrium*, thematic period, IHP Paris (2017)

• *Stochastic Processes and Applications*, seminar in invited Section, Moscow (2017)

• *Geometry and scaling of random structures*, Buenos Aires (2018)

Teaching

Undergraduated Courses

The courses tagged as MAT/07 (the scientific sector of Mathematical-Physics) are written in **boldface**. All the under-graduated courses have been given at University of L'Aquila.

• 2000-2001: Exercises for the course of **Rational Mechanics**.

• 2001-2002: Exercises for the course of *Ordinary Differential Equations*; exercises for the course of **Rational Mechanics**.

• 2002-2003: Exercises for the course of *Probability*; exercises for the course of **Rational mechanics**.

• 2003-2004: course of *Stochastic processes II*; exercises for the course *Probability*.

• 2004-2005: course of *Probability*; exercises for the course of **Mathematical Models of Macroscopic Systems.**

• 2005-2006: course on *Probability and Statistics*

• 2006-2007: course of *Stochastic processes II*; course of **Mathematical Models of Macroscopic systems**

• 2007-2008: course of *Stochastic Processes*; exercises for the course of **Mathematical Physics I**

• 2008-2009: course of *Stochastic Processes*; course of *Probability*

• 2009-2010: course of *Probability*; exercises for the course **Mathematical Physics II**

• 2010-2011: course of **Equations of Mathematical Physics**; exercises for the course *Probability for Finance*

• 2011-2012 course of **Equations for Mathematical Physics**; exercises for the course of *Stochastic Processes*

• 2012-2013: course of **Equations for Mathematical Physics**

• 2013-2014: course of Probability and Stochastic Processes, exercises for the course of **Rational Mechanics**

• 2014-2015: course on *Probability and Statistics*; course on *Probability and Stochastic Processes I*

• 2015-2016: course on *Probability and Statistics*; course on *Probability and Stochastic Processes I*; course on *Didactic of Probability and Statistics*

• 2016-2017: course on *Probability and Statistics*; course on *Probability and Stochastic Processes I*; course on *Didactic of Probability and Statistics*

• 2017-2018: course on *Probability and Statistics*; course on *Probability and Stochastic Processes I*; course on *Didactic of Probability and Statistics*

• 2018-2019: course on *Probability and Statistics*; course on *Probability and Stochastic Processes I*; exercises of **Rational Mechanics**

PhD courses:

• 2001-2002: *Introduction to Hydrodynamic Limits and Fluctuations*, University of Wien, (12 hours)

• 2003-2004: *Elements of statistical mechanics*, University of L'Aquila, (20 hours)

• 2013-2014: *Large deviations and Statistical Mechanics*, Scuola Normale Superiore di Pisa, (30 hours)

• 2017-2018: *Stochastic models and methods*, University of L'Aquila, short course, (6 hours)

Thesis

I have been supervisor of the following thesis

Old 4 year master thesis

• 2001: Valentina Mammarella *Coupling regenerations and perfect simulations for chains of complete connection*

• 2002: Giuseppe Sebastiano, *Large deviations for the empirical entropy of a Bernoulli process*

• 2003: Carla Valente, *Clusters representations of Gibbs measures*

• 2004: Medarse Iacovella, *Interacting particle systems: construction and asymptotic behavior*

• 2005: Giampaolo Silveri, *The BKR inequality*

• 2005: Carla De Iuliis, *Random walks and electrical networks*

Triennal Thesis

• Donato Ferrara (2007), Selena De Lutiis (2007), Laura De Sanctis (2010), Francesca Aceto (2015), Nicola Bucceroni (2015), Giuseppe Farinacci (2015), Roberta Guglietti (2018)

Master Thesis

• 2007: Marco Ribezzi Crivellari, *Large deviations principles for piecewise deterministic Markov processes and applications to molecular motors*, master thesis in Physics, Sapienza University of Roma, co-supervised jointly with Alessandra Faggionato and Giovanni Jona Lasinio. The main results are published on the papers [22], [23]

• 2015: Andrea De Angelis, *Entropy, intricacy and neural complexity*

• 2017: Monika Stanislawska, *Entropy and Applications*

• 2018: Riccardo Pallottini, *Extremal measures for mass transportation problems with Martingale constraints*

PhD Thesis:

• 2010: Carla Valente, *Some Problems on Large Deviations and Convex Analysis*. The main results of the thesis are published on the paper [27]. Carla Valente is currently professor in a high school.

• 2016: Fabio Roncari, *Stationary non equilibrium states: several components, different regimes and toy models*. The main results of the thesis are published on the paper [36]. Fabio Roncari is currently professor in a high school.

• 2017: Leonardo De Carlo (student of the GSSI, L'Aquila), *Microscopic and macroscopic perspectives on stationary non equilibrium states*. The main results of the thesis are published on the papers [37], [38]. Leonardo De Carlo is currently a postdoc fellow at University of Lisbon.

PhD Defense Committee

• 2015: Member of the defence commitee of the PhD thesis of Horacio Gonzalez Duhart Muoz De Cote, supervisors Johannes Zimmer and Peter Mörters, Bath.

• 2017: Member of the defense committee of the PhD thesis of Luisa Andreis, supervisor Paolo Dai Pra, Padova.

• 2018: Member of the defence commitee of the PhD thesis of Byron Jimenez-Oviedo, supervisors Cedric Bernardin and Patricia Gonçalves, Nice.

Organization

• Member of the organizing committee of the conference : *Dynamical Systems: Classical, Quantum and Stochastic.* Roma, (2005).
• Member of the organizing committee of the workshop *Sviluppi Recenti in Fisica Matematica*, L'Aquila (2009).

Administrative Work

• 2004-2008: Member of the *orientation committee* of the Mathematics Department, University of L'Aquila.

• 2006-2008: Member of the *library committee* of the Mathematics Department, University of L'Aquila.

• 2008-2010: Head of the *orientation committee* of the Mathematics Department, University of L'Aquila.

• 2008-2011: Member of the Ph.D. council in *Engineering and Mathematical Physical Modeling*, University of L'Aquila

• From 2011: Member of the Ph.D. council in *Mathematics and Models*, University of L'Aquila

• 2012: Member of the *committee for the rationalization of the teaching offer* for the course on Mathematics

• 2015: Member of the internal committee of DISIM for the VQR 2011-2014 evaluation of research.

• From 2016: Member of the Department website editorial committee.

• From 2017: vice coordinator of the PhD program *Mathematics and models*, University of L'Aquila

• From 2017: member of the *Riesame committee* of the council of teaching area (CAD) of Mathematics

• From 2018: Member of the *Giunta* of the DISIM department, University of L'Aquila

• From 2018: Member of the *research committee* of the Mathematics Department, University of L'Aquila

Grants

• I participated as an Investigator to several Italian PRIN projects

• 2008: Principal Investigator (P.I.) of a young researcher project of the Italian GNFM

• From 2017 I am the coordinator of the RIA internal funding for the groups of Mathematical-Physics and Probability of my department.

• 2017: FFABR individual financing from italian MIUR

Editorial activity

• Referee for the following journals: *Alea*, *Annales de L'Institite Henri Poincaré Probabilités et Statistiques*, *Annales Henri Poincaré*, *Annals of Applied Probability*, *Annals of Probability*, *Bollettino dell'Unione Matematica Italiana*, *Brazilian Journal of Probability and Statistics*, *Communication on Mathematical Physics*, *Entropy*, *Forum of Mathematics Sigma*, *Journal of Physics A*, *Journal of Statistical Physics*, *Journal of the European Mathematical Society*, *Stochastic Processes and Their Applications*, *Physical Review E*, *Physical Review Letters*, *Probability Theory and Related Fields*, *Proceedings of the National Academy of Sciences of the United States of America*, *PRX*

• Starting from 2015 I am Associate Editor of *Annals of Probability*

Publications

International Journals:

1) D. Gabrielli, G. Jona-Lasinio, C. Landim - *Onsager Reciprocity Relations Without Microscopic Reversibility* Phys. Rev. Lett. **77**, 1202-1205, (1996)

2) D. Gabrielli, G. Jona-Lasinio, C. Landim *Reply to the comment of J.L. Lebowitz and H. Spohn* Phys. Rev. Lett. **78**, 395, (1997)

3) D. Gabrielli *Polymeric Phase of Simplicial Quantum Gravity* Phys. Lett. B **421**, no. 1-4, 79-85, (1998)

4) J. Ambjörn, M. Carfora, D. Gabrielli, A. Marzuoli *Crumpled Triangulations and Critical Points in 4D Simplicial Quantum Gravity* Nucl. Phys. B **542**, 349-394, (1999)

5) D. Gabrielli, G. Jona-Lasinio, C. Landim *Onsager Symmetry from microscopic TP invariance*, J. Stat. Phys. **96**, N 3/4, 639-652, (1999)

6) L. Bertini, A. De Sole, D. Gabrielli, G. Jona-Lasinio, C. Landim, *Fluctuations in stationary nonequilibrium states of irreversible processes.* Phys. Rev. Lett. **87**, no. 4, 040601, 4 pp. (2001)

7) L. Bertini, A. De Sole, D. Gabrielli, G. Jona-Lasinio, C. Landim, *Macroscopic fluctuation theory for stationary non-equilibrium states.* J. Stat. Phys. **107**, no. 3-4, 635–675, (2002)

8) L. Bertini, A. De Sole, D. Gabrielli, G. Jona-Lasinio, C. Landim, *Large deviations for the boundary driven symmetric simple exclusion process.* Math. Phys. Anal. Geom. 6, no. 3, 231–267, (2003)

9) D. Gabrielli, A. Galves, D. Guiol, *Fluctuations of the empirical entropies of a chain of infinite order.* Math. Phys. Electron. J. **9**, Paper 5, 17 pp. (2003)

10) L. Bertini, A. De Sole, D. Gabrielli, G. Jona-Lasinio, C. Landim, *Minimum dissipation principle in stationary non-equilibrium states.* J. Stat. Phys. **116**, no. 1-4, 831–841 (2004)

11) L. Bertini, A. De Sole, D. Gabrielli, G. Jona-Lasinio, C. Landim, *Current fluctuations in stochastic lattice gases* Phys. Rev. Lett. **94**, 030601 (2005)

12) L. Bertini, D. Gabrielli, J.L. Lebowitz, - *Large deviations for a stochastic model of heat conduction* J. Stat. Phys., **121**, No. 5/6, 843-885, (2005)

13) J.R. Chazottes, D. Gabrielli, *Large deviations for empirical entropies of g-measures* Nonlinearity **18**, no. 6, 2545-2563, (2005)

14) L. Bertini, A. De Sole, D. Gabrielli, G. Jona-Lasinio, C. Landim, *Non equilibrium current fluctuations in stochastic lattice gases* J. Stat. Phys., **123**, No. 2, 237-276 (2006)

15) L. Bertini, A. De Sole, D. Gabrielli, G. Jona-Lasinio, C. Landim, *Large deviation approach to non equilibrium processes in stochastic lattice gases* Bull. Braz. Math. Soc., New Series **37**(4), 611-643, (2006)

16) D. Benedetto, E. Caglioti, D. Gabrielli, *Non-sequential recursive pair substitution: some rigorous results* J. Stat. Mech. P09011 (2006)

17) L. Bertini, A. De Sole, D. Gabrielli, G. Jona-Lasinio, C. Landim, *Large deviations of the empirical current in interacting Particle systems* Theory Probab. Appl., **51**, No. 1, 2–27, (2007)

18) L. Bertini, A. De Sole, D. Gabrielli, G. Jona-Lasinio, C. Landim, - *Stochastic interacting particle systems out of equilibrium* J. Stat. Mech., P07014 (2007)

19) D. Gabrielli, *From combinatorics to large deviations for the invariant measures of some multiclass particle systems* Markov Processes Relat. Fields **14**, 365-402 (2008)

20) L. Bertini, A. De Sole, D. Gabrielli, G. Jona-Lasinio, C. Landim, *Towards a nonequilibrium thermodynamics: a self-contained macroscopic description of driven diffusive systems* J. Stat. Phys. **135**, 857-872, (2009)

21) L. Bertini, D. Gabrielli, C. Landim, *Strong asymmetric limit of the quasi-potential of the boundary driven weakly asymmetric exclusion process* Comm. Math. Phys. **289**, n 1, 311-334, (2009)

22) A. Faggionato, D. Gabrielli, M. Ribezzi-Crivellari, *Non-equilibrium Thermodynamics of piecewise deterministic Markov processes.* J. Stat. Phys. **137**,n 2, 259-304 (2009)

23) A. Faggionato, D. Gabrielli, M. Ribezzi-Crivellari, *Averaging and large deviation principles for fully-coupled piecewise deterministic Markov processes and applications to molecular motors.* Markov Processes Relat. Fields **16**, n 3, 497-548, (2010)

24) L. Bertini, A. De Sole, D. Gabrielli, G. Jona-Lasinio, C. Landim *Lagrangian phase transitions in nonequilibrium thermodynamic systems* J. Stat. Mech. L11001 (2010)

25) L. Bertini, A. De Sole, D. Gabrielli, G. Jona-Lasinio, C. Landim, *Action functional and quasi-potential for the Burgers equation in a bounded interval* Comm. Pure Appl. Math. **64**, n 5, 649-696, (2011)

26) A. Faggionato; D. Gabrielli *A representation formula for large deviations rate functionals of invariant measures on the one dimensional torus* Ann. Inst. Henri Poincaré Probab. Stat. , **48**, No 1, 212-234 (2012)

27) D. Gabrielli, C. Valente *Which random walks are cyclic?* ALEA, Lat. Am. J. Probab. Math. Stat. **9**, 231-267 (2012)

28) L. Bertini; D. Gabrielli; G. Jona-Lasinio; C. Landim *Thermodynamic transformations of nonequilibrium states* J. Stat. Phys. **149**, 773-802 (2012)

29) L. Bertini, A. Faggionato, D. Gabrielli *Large deviations principles for non gradient weakly asymmetric stochastic lattice gases.* Ann. Appl. Prob. **23**, no. 1, 1-65, (2013)

30) L. Bertini; D. Gabrielli; G. Jona-Lasinio; C. Landim *Clausius inequality and optimality of quasi static transformations for nonequilibrium stationary states* Phys. Rev. Lett. **110**, 020601 (2013)

31) L. Bertini, A. Faggionato, D. Gabrielli *From level 2.5 to level 2 large deviations for continuous time Markov chains* Markov processes and Related Fields **20** 3, 545-562 (2014)

32) L. Bertini, A. Faggionato, D. Gabrielli - *Large deviations of the empirical flow for continuous time Markov chains* Ann. Inst. H. Poincaré Probab. Stat. **51**, no. 3, 867-900 (2015)

33) L. Bertini; A, De Sole; D. Gabrielli; G. Jona-Lasinio; C. Landim *Macroscopic fluctuation theory* Rev. Modern Phys. **87**, no.2, 593-636 (2015)

34) L. Bertini, A, Faggionato, D. Gabrielli *Flows, currents, and cycles for Markov Chains: large deviation asymptotics* Stochastic Processes and their Applications, **125**, 7, 2786-2819 (2015)

35) L. Bertini, A. De Sole, D. Gabrielli, G. Jona Lasinio, C. Landim *Quanitative analysis of Clausius inequality* J. Stat. Mech. Theory and Experiment P10018 (2015)

36) D. Gabrielli, F. Roncari *The energy of the alphabet model* Ann. Henri Poincaré **18**, no. 6, 1977-2006 (2017)

37) L. De Carlo, D. Gabrielli *Totally asymmetric limit for models of heat conduction* J. Stat. Phys. **168** (3), 508-534 (2017)

38) L. De Carlo, D. Gabrielli *Gibbsian stationary non equilibrium states* J. Stat. Phys. **168**, no. 6, 11911222 (2017)

39) D. Gabrielli, P. L. Krapivsky *Gradient structure and transport coefficients for strong particles* J. Stat. Mech. 043212 (2018)

40) L. Bertini, R. Chetrite, A. Faggionato, D. Gabrielli *Level 2.5 large deviations for continuous time Markov chains with time periodic rates* Ann. Henri Poincaré **19** (2018), 3197-3238

41) A. C Barato, R. Chetrite, A. Faggionato, D. Gabrielli *Bounds on current fluctuations in periodically driven systems* New J. Phys. **20** (2018) 103023

42) D. Andreucci, E. N. M. Cirillo, M. Colangeli, D. Gabrielli *Fick and Fokker–Planck diffusion law in inhomogeneous media* J Stat Phys (2018). https://doi.org/10.1007/s10955-018-2187-6

43) D. Gabrielli, I.G. Minelli *Stochastic monotonicity from an Eulerian viewpoint* Braz. J. Probab. Stat., to appear

Proceedings:

44) D. Gabrielli, G. Jona-Lasinio, C. Landim, M.E. Vares, *Microscopic Reversibility and Thermodynamic Fluctuations* In proceedings of the conference "Boltzmann Legacy" Rome (1994), Atti dei Convegni Lincei **131**, 79, (1997)

45) M. Carfora, D. Gabrielli, G. Gionti, *Recent Developments in 4-D Simplicial Quantum Gravity* Proceedings of 12th Italian Conference on General Relativity and Gravitational Physics 111 World Scientific (1997)

Other Publications:

46) D. Gabrielli *Exercises for the 9-th Brazilian School of Probability*, (2005) (http://www.ime.usp.br/ebp/ebp9/)

47) L. Bertini, A. De Sole, D. Gabrielli, G. Jona-Lasinio, C. Landim, *On the long range correlations of thermodynamic systems out of equilibrium* arXiv:0705.2996, unpublished (2007)

Preprints:

48) A. C Barato, R. Chetrite, A. Faggionato, D. Gabrielli *A unifying picture of generalized thermodynamic uncertainty relations* arXiv:1810.11894

Ongoing research

The following papers are in a final or advanced stage

• P.A. Ferrari, D. Gabrielli *BBS invariant measures with independent soliton components*

• P.A. Ferrari, D. Gabrielli *Combinatorics and geometry around box ball system*

• L. De Carlo, D. Gabrielli, P. Gonçalves *Scaling limit for a turbulent exclusion process*

• D. Gabrielli, D.R.M. Renger *Dynamic phase transitions for systems with entropic cost functions*

Short description of the research results

Non equilibrium statistical mechanics

This is my main line of research. Mainly jointly with L. Bertini, A. De Sole, G. Jona Lasinio and C. Landim, I developed a general macroscopic theory for fluctuations of out of equilibrium systems. This is called *Macroscopic Fluctuation Theory* (MFT) and is recognized as a major breakthrough in non equilibrium thermodynamics. This is remarked by the mention of MFT both in the motivations for the 2012 Dannie Heineman prize for mathematical physics and in the motivations for the 2013 Boltzmann medal. We point out the invited paper [33] on one of the most important journals on Physics. The following papers can be classified along this line of research [1], [2], [5], [6], [7], [10], [11], [12], [14], [18], [20], [24], [28], [30], [33], [35], [37], [42], [44], [46], [47]

Large deviations

The development of MFT generated a number of different probabilistic and variational problems around fluctuations of particle systems. In the following papers I discussed problems of this type [8], [15], [17], [19], [21], [25], [26], [29]

Random surfaces and quantum gravity

The Euclidean version of path integral quantization of gravity is naturally formulated as a model of random Riemannian manifolds. The continuous version is mathematically ill defined. A natural approach is to discretize the problem performing afterwards a continuum limit. I studied and characterized the polymeric and crumpled phases and the corresponding phase transitions for random discrete geometric models of this type [3], [4], [45]

Information theory

I studied the problem of estimation of the Shannon entropy of a random source starting from a finite sample. This problem is extremely important both from the theoretic and the applicative viewpoint in coding data. I used techniques of different type: stochastic processes with infinite memory, dynamical systems, combinatorial analysis. Papers along this line of research are [9], [13], [16]

Models for biology

I studied a class of piecewise deterministic stochastic models. I studied the high frequency limit, the corresponding large deviations, and discussed a class of exactly solvable models. The motivation comes from biology since this class of models exhibits behaviors typical of molecular motors. Results of this type are in [22], [23]

Graphs, combinatorics and particle systems

In a series of papers I applied techniques typical of combinatorics, discrete geometry, graph theory and convex analysis to the solution of probabilistic problems. The results are of different type and the corresponding papers are [27], [36], [38], [39], [43]

Currents fluctuations on networks

I studied large deviations for the flow of mass through the channels of a network both finite and infinite. I studied both the time homogeneous case and the time inhomogeneous one. The results are relevant for the study of fluctuations of small physical systems. In particular I obtained generalizations to the time inhomogeneous case of the celebrated thermodynamic uncertainty relations. The paper along this line of research are [31], [32], [34], [40], [41], [48]

Bibliometric data

- Mathscinet: 430 citations, h-index 11
- ISI Web of Science: 1317 citations, h-index 17
- Scopus: 1427 citations, h-index 18
- Google Scholar: 2061 citations, h-index 21

L'Aquila 26/11/2018