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# Marco Zamparo
# CURRICULUM VITAE

## INFORMAZIONI PERSONALI (NON INSERIRE INDIRIZZO PRIVATO E TELEFONO FISSO O CELLULARE)

| | |
|---|---|
| **COGNOME** | **ZAMPARO** |
| **NOME** | **MARCO** |
| **DATA DI NASCITA** | 14 GENNAIO 1979 |

## RESEARCH PROFILE

I GRADUATED IN NUCLEAR ENGINEERING WITH HONOURS AT POLYTECHNIC UNIVERSITY OF TURIN IN 2005, WHERE I RECEIVED A EUROPEAN PHD IN PHYSICS IN 2009 AND I WAS AWARDED FOR THE MOST OUTSTANDING DOCTORAL RESEARCH IN 2008. MY RESEARCH INTERESTS LIE IN THE FIELDS OF STATISTICAL MECHANICS AND STATISTICAL PHYSICS, PROBABILITY THEORY, STATISTICAL INFERENCE, AND MATHEMATICAL MODELLING OF BIOLOGICAL SYSTEMS. DURING THE PHD AND AFTERWARDS, I FOCUSED ON THE MODELLING OF PROTEIN FOLDING [1-4,9], MECHANICAL PROTEIN UNFOLDING [5,6,8,12], AND TO A SMALLER EXTENT PROTEIN AGGREGATION [10]. IN THIS CONTEXT, I MANAGED TO SOLVE A STATISTICAL MECHANICAL MODEL WITH QUENCHED DISORDER [7]. SUBSEQUENTLY, I CONTRIBUTED TO THE MODELLING OF FINANCIAL ASSET DYNAMICS AND TO MATHEMATICAL FINANCE BY DEVELOPING A STOCHASTIC PROCESS BASED ON OBSERVED SCALING SYMMETRIES OF ASSETS' RETURNS [13-14] AND BY USING THE PROCESS TO TACKLE AN OPTION PRICING PROBLEM [16]. I ALSO PROVIDED A CONCLUSIVE SOLUTION TO A 20-YEAR OPEN PROBLEM REGARDING THE APPARENT MULTIFRACTALITY OF SELF-SIMILAR LÉVY PROCESSES [19]. IN THE FRAMEWORK OF STATISTICS AND BAYESIAN INFERENCE, I PROPOSED AN EXTENSION OF FACTOR ANALYSIS TO TIME SERIES WITH LATENT GAUSSIAN PROCESSES [11] AND I CONTRIBUTED TO DEVISE A MODEL FOR PREDICTION OF INTRA-PROTEIN RESIDUE-RESIDUE CONTACTS [15], AS WELL AS FOR IDENTIFICATION OF INTERACTING FAMILIES IN MULTIPROTEIN SYSTEMS [18]. IN PARALLEL TO THIS, I WROTE A REVIEW PAPER ON CELL SIGNALLING WITH COLLEAGUES [17] AND I HAVE BEEN WORKING ON A STOCHASTIC LATTICE-GAS MODEL TO DESCRIBE MOLECULAR SORTING PROCESSES [25] AND CELL-POLARISATION PROCESSES [27]. THIS WORK HAS LED ME TO DISCOVER THAT A SIMPLE FORMULA EXISTS FOR THE MEAN TIME THAT PARTICLES SPEND IN A LATTICE WITHIN STOCHASTIC INTERACTING PARTICLE SYSTEMS [20]. I HAVE ALSO BEEN INVOLVED IN THE STUDY OF DYNAMICAL PHASE TRANSITIONS IN PERTURBATIONS OF THE TOTALLY ASYMMETRIC SIMPLE EXCLUSION PROCESS WITH OPEN BOUNDARIES [21,23]. RECENTLY, I HAVE ESTABLISHED SHARP LARGE DEVIATION PRINCIPLES FOR CUMULATIVE REWARDS IN THE CONTEXT OF DISCRETE-TIME RENEWAL THEORY [24] AND I HAVE USED THESE RESULTS TO INVESTIGATE RENEWAL MODELS OF STATISTICAL MECHANICS [22], SUCH AS MODELS FOR POLYMER PINNING. IN THE FRAMEWORK OF RENEWAL MODELS OF STATISTICAL MECHANICS, I HAVE ALSO STUDIED PRECISE LARGE DEVIATIONS FOR SYSTEMS AT CRITICALITY, WHEREBY PROBABILITY DECAYS ARE SUBEXPONENTIAL [26]. I AM CURRENTLY INVESTIGATING QUENCHED LARGE DEVIATION PRINCIPLES IN RENEWALS MODELS AND POLYMER PINNING MODELS WITH DISORDER [28]. IN A DIFFERENT RESEARCH LINE, I AM PROBING THE TRANSPORT PROPERTIES, BOTH QUENCHED AND ANNEALED, OF A RANDOM WALK IN A HEAVY-TAILED RANDOM ENVIRONMENT [29]. IN CONCLUSION, I HAVE AUTHORED 22 PUBLICATIONS ON ISI-INDEXED INTERNATIONAL JOURNALS, WITH A TOTAL OF 303 CITATIONS (263 WITHOUT SELF-CITATIONS) AND AN H-INDEX OF 10. I HAVE BEEN A REGULAR LECTURER IN CONTINUUM MECHANICS AND FLUID DYNAMICS IN THE INTERNATIONAL MASTER OF SCIENCE PROGRAMME IN PHYSICS OF COMPLEX SYSTEMS AT POLYTECHNIC UNIVERSITY OF

Turin from 2013 to 2017. In 2019 I obtained the Italian National Scientific Qualification as Associated Professor in Mathematical Physics.

**Education and Qualifications**

- Italian National Scientific Qualification (ASN) as Associated Professor
  Sector 01/A4 - Mathematical Physics
  9 September 2019 - 9 September 2028

- European PhD in Physics
  Polytechnic University of Turin, Department of Physics, 5 February 2009
  Thesis title: *Wako-Saitô-Muñoz-Eaton model: protein folding kinetics and stretching*
  Advisor: Prof. Alessandro Pelizzola

- Master of Science in Nuclear Engineering
  Polytechnic University of Turin, 18 July 2005
  Thesis title: *Metodi meccanico-statistici per il ripiegamento delle proteine*
  Advisor: Prof. Alessandro Pelizzola
  Marks: 110/110 *cum laude*

**Awards**

- 2008 Quality Award for the most outstanding doctoral research

**Publications**

1. M. Zamparo and A. Pelizzola,
   *Kinetics of the Wako-Saitô-Muñoz-Eaton model of protein folding*,
   Phys. Rev. Lett. 97 068106 (2006)

2. M. Zamparo and A. Pelizzola,
   *Rigorous results on the local equilibrium kinetics of a protein folding model*,
   J. Stat. Mech. P 12009 (2006)

3. P. Bruscolini, A. Pelizzola, and M. Zamparo,
   *Downhill versus two-state protein folding in a statistical mechanical model*,
   J. Chem. Phys. 126 215103 (2007)

4. P. Bruscolini, A. Pelizzola, and M. Zamparo,
   *Rate determining factors in protein model structures*,
   Phys. Rev. Lett. 99 038103 (2007)

5. A. Imparato, A. Pelizzola, and M. Zamparo,
   *Ising-like model for protein mechanical unfolding*,
   Phys. Rev. Lett. 98 148102 (2007)

6. A. Imparato, A. Pelizzola, and M. Zamparo,
   *Protein mechanical unfolding: a model with binary variables*,
   J. Chem. Phys. 127 145105 (2007)

7. M. Zamparo,
   *An exactly solvable model for a b-hairpin with random interactions*,
   J. Stat. Mech. P 10013 (2008)

8. A. Imparato, A. Pelizzola, and M. Zamparo,
*Equilibrium properties and force-driven unfolding pathways of RNA molecules*,
Phys. Rev. Lett. 103 188102 (2009)

9. M. Zamparo and A. Pelizzola,
*Nearly symmetrical proteins: folding pathways and transition states*,
J. Chem. Phys. 131 035101 (2009)

10. M. Zamparo, A. Trovato, and A. Maritan,
*Simplified exactly solvable model for β-amyloid aggregation*,
Phys. Rev. Lett. 105 108102 (2010)

11. M. Zamparo, S. Stramaglia, J.R. Banavar, and A. Maritan,
*Inverse problem for multivariate time series using dynamical latent variables*,
Phys. A 391 3159-3169 (2012)

12. A. Pelizzola and M. Zamparo,
*Nonequilibrium dynamics of an exactly solvable Ising-like model and protein translocation*,
Europhys. Lett. 102 10001 (2013)

13. F. Baldovin, F. Camana, M. Caraglio, A.L. Stella, and M. Zamparo,
*Aftershock prediction for high-frequency financial markets' dynamics*,
in F. Abergel, B.K. Chakrabarti, A. Chakraborti, A. Ghosh, eds., *Econophysics of Systemic Risk and Network Dynamics* (New Economic Windows, Springer 2013), pp. 49-58

14. M. Zamparo, F. Baldovin, M. Caraglio, and A.L. Stella,
*Scaling symmetry, renormalization, and time series modeling: The case of financial assets dynamics*,
Phys. Rev. E **88** 062808 (2013)

15. C. Baldassi, M. Zamparo, C. Feinauer, A. Procaccini, R. Zecchina, M. Weigt, and A. Pagnani,
*Fast and accurate multivariate Gaussian modeling of protein families: Predicting residue contacts and protein-interaction partner*,
PLOS ONE **9** e92721 (2014)

16. F. Baldovin, M. Caporin, M. Caraglio, A.L. Stella, and M. Zamparo,
*Option pricing with non-Gaussian scaling and infinite-state switching volatility*,
J. Econometrics **187** 486-497 (2015)

17. M. Zamparo, F. Chianale, C. Tebaldi, M. Cosentino-Lagomarsino, M. Nicodemi, and A. Gamba,
*Dynamic membrane patterning, signal localization and polarity in living cells*,
Soft Matter **11** 838-849 (2015)

18. T. Gueudre, C. Baldassi, M. Zamparo, M. Weigt, and A. Pagnani,
*Simultaneous identification of specifically interacting paralogs and inter-protein contacts by Direct-Coupling Analysis*,
Proc. Natl. Acad. Sci. U.S.A. **113** 12186-12191 (2016)

19. M. Zamparo,
*Apparent multifractality of self-similar Lévy processes*,
Nonlinearity **30** 2592-2611 (2017)

20. M. Zamparo, L. Dall'Asta, and A. Gamba,
*On the mean residence time in stochastic lattice-gas models*,
J. Stat. Phys. **30** 120-134 (2019)

21. D. Botto, A. Pelizzola, M. Pretti, and M. Zamparo,
*Dynamical transition in the TASEP with Langmuir kinetics: mean-field theory*,
J. Phys. A: Math. Theor. **52** 045001 (2019)

22. M. Zamparo,
*Large deviations in renewal models of Statistical Mechanics*,
J. Phys. A: Math. Theor. **52** 495004 (2019)

23. D. Botto, A. Pelizzola, M. Pretti, and M. Zamparo,
*Unbalanced Langmuir kinetics affects TASEP dynamical transitions: mean-field theory*,
to appear in J. Phys. A: Math. Theor. (arXiv:2001.05741)

SUBMITTED

24. M. Zamparo,
*Large deviations in discrete-time Renewal Theory*,
(arXiv:1903.03527)

25. M. Zamparo, D. Valdembri, G. Serini, I.V. Kolokolov, V.V. Lebedev, L. Dall'Asta, and A. Gamba,
*Optimality in self-organized molecular sorting*,
arXiv:1811.06760

26. M. Zamparo,
*Critical fluctuations in renewal models of Statistical Mechanics*,
arXiv:2006.09298

IN PREPARATION

27. J. Vollmer, A. Gamba, and M. Zamparo,
*Domain drift and diffusion in cell-polarization processes*

28. M. Zamparo and F. den Hollander,
*Quenched large deviations in Renewal Theory*

29. M. Zamparo,
*Transport properties of a random walk in a one-dimensional Lévy random environment*

**Major Collaborations**

- Carlo Baldassi. Bocconi University, Department of Decision Sciences, 2 joint publications
- Fulvio Baldovin. University of Padua, Department of Physics and Astronomy, 3 joint publications
- Jayanth Banavar. University of Maryland, Department of Physics, 1 joint publication
- Pierpaolo Bruscolini. University of Zaragoza, Department of Theoretical Physics, 2 joint publications
- Massimiliano Caporin. University of Padua, Department of Statistical Sciences, 1 joint publication
- Marco Cosentino-Lagomarsino. Sorbonne University and CNRS, Institut de Biologie Paris-Seine, Laboratory of Computational and Quantitative Biology, 1 joint publication

- Luca Dall'Asta. Polytechnic University of Turin, Department of Applied Science and Technology, 1 joint publication
- Andrea Gamba. Polytechnic University of Turin, Department of Applied Science and Technology, 2 joint publications
- Alberto Imparato. Aarhus University, Department of Physics and Astronomy, 3 joint publications
- Amos Maritan. University of Padua, Department of Physics and Astronomy, 2 joint publications
- Mario Nicodemi. University of Naples Federico II, Department of Physics, 1 joint publication
- Andrea Pagnani. Polytechnic University of Turin, Department of Applied Science and Technology, 2 joint publications
- Alessandro Pelizzola. Polytechnic University of Turin, Department of Applied Science and Technology, 11 joint publications
- Marco Pretti. National Research Council (Italy), Institute for Complex Systems, 2 joint publications
- Attilio Stella. University of Padua, Department of Physics and Astronomy, 3 joint publications
- Sebastiano Stramaglia. University of Bari Aldo Moro, Department of Physics, 1 joint publication
- Antonio Trovato. University of Padua, Department of Physics and Astronomy, 1 joint publication
- Martin Weigt. Sorbonne University and CNRS, Institut de Biologie Paris-Seine, Laboratory of Computational and Quantitative Biology, 2 joint publications
- Riccardo Zecchina. Bocconi University, Department of Decision Sciences, 1 joint publication

**Research Fellowships**

- Fellow in Statistical Mechanics in the group of Prof. Alessandro Pelizzola. Polytechnic University of Turin, Department of Applied Science and Technology, 16 January 2020 - 15 January 2021
- Postdoc in Mathematical Physics in the group of Prof. Andrea Gamba. Polytechnic University of Turin, Department of Applied Science and Technology, 16 January 2018 - 15 January 2020

  Postdoc in Statistical Inference in the group of Prof. Alfredo Braunstein. Polytechnic University of Turin, Department of Applied Science and Technology, 16 July 2016 - 15 January 2018
- Postdoc in Statistical Physics in the group of Prof. Riccardo Zecchina. Polytechnic University of Turin, Department of Applied Science and Technology, 1 December 2013 - 31 May 2016
- Researcher in Statistical Physics in the group of Prof. Riccardo Zecchina. Human Genetics Foundation - Torino, 1 January 2012 - 30 November 2013

- Postdoc in Econophysics in the group of Prof. Attilio Stella. University of Padua, Department of Physics and Astronomy, 1 May 2010 - 31 December 2011

- Postdoc in Protein Physics in the group of Prof. Amos Maritan. University of Padua, Department of Physics and Astronomy, 1 January 2009 - 30 April 2010

- PhD fellow in Physics. Polytechnic University of Turin, Department of Physics, 1 January 2006 - 31 December 2008

- Fellow in Statistical Mechanics in the group of Prof. Alessandro Pelizzola. Polytechnic University of Turin, Department of Physics, 1 September 2005 - 31 December 2005

**Project Participation**

- PRIN 2007 (2 years) "Amiloidi e ripiegamento di proteine: un approccio teorico-sperimentale'". Coordinator: Prof. Amos Maritan

- Progetto di Eccellenza 2008-2009 Fondazione Cassa di Risparmio di Padova e Rovigo (2 years) "Anomalous scaling in physics and finance'". Coordinator: Prof. Attilio Stella

- PRIN 2010-2011 (3 years) "Statistical mechanics of disordered and complex systems'". Coordinator: Prof. Giorgio Parisi

**Conferences and Seminars**

- Workshop "Interdisciplinary Topics in Statistical Physics: a meeting in honor of Attilio Stella'". Padova, 19 - 20 September 2019. Invited talk: *Apparent multifractality of self-similar Lévy processes*

- Italian national conference on Statistical Physics and Complex Systems. Parma, 24 - 26 June 2019.

- Workshop "Statistical Physics Approaches to Systems Biology'". Havana, 14 - 15 February 2019. Talk: *Large deviation principles in renewal theory*

- Italian national conference on Statistical Physics and Complex Systems. Parma, 20 - 22 June 2018. Invited talk: *On the mean residence time in stochastic lattice-gas models*

- University of Zaragoza, Institute for Biocomputation and Physics of Complex Systems, 4 May 2018. Invited seminar: *Residence time and optimality in self-organized molecular sorting*

- Polytechnic University of Turin, Department of Mathematics, 19 April 2018. Invited seminar: *Large deviation principles in renewal theory*

- University of Padua, Department of Mathematics, 23 March 2018. Invited seminar: *Large deviation principles in renewal theory*

- SM&FT 2017. Bari, 13 - 15 December 2017. Invited talk: *Large deviations in renewal models of statistical mechanics*

- Biophys 2017. Pisa, 25 - 26 September 2017. Talk: *Optimality in self-organizing molecular sorting*

- Assemblea Scientifica GNFM. Montecatini Terme (Pistoia), 4 - 6 May 2017. Talk: *Apparent multifractality of self-similar Lévy processes*

- Italian national conference on Statistical Physics and Complex Systems. Parma, 29 June - 1 July 2015. Invited talk: *A solvable example of non-strictly-convex large deviation principle in statistical mechanics*

- Conference "Regulation and inference in biological systems'". Bardonecchia (Turin), 2 - 6 February 2015

- Workshop "Protein physics: structure, dynamics and function'". Brixen (Bolzano), 6 - 8 February 2014. Invited talk: *Nonequilibrium dynamics of an exactly solvable Ising-like model and protein translocation*

- Workshop "Statistical modeling, financial data analysis and applications'". Venice, 11 - 14 September 2013. Invited talk: Scaling symmetry and financial time series modeling

- Italian national conference on Statistical Physics and Complex Systems. Parma, 24 - 26 June 2013

- Italian national conference on Statistical Physics and Complex Systems. Parma, 22 - 24 June 2011

- Workshop "Quantitative finance'". Padua, 27 - 28 January 2011

- Workshop "Physics of protein folding and aggregation'". Brixen (Bolzano), 11 - 12 February 2010

- Workshop "Interdisciplinary topics in statistical mechanics'". Venice, 16 - 18 April 2009

- Biophys 2008. Arcidosso (Grosseto), 10 - 12 September 2008. Talk: *Pathways and transition states in protein folding*

- Italian national conference on Statistical Physics and Complex Systems. Parma, 23 - 25 June 2008. Poster: *Application of spectral coarse-graining to a protein folding model*

- Statphys 23. Genova, 9 - 13 July 2007. Poster: *Wako-Saitô-Muñoz-Eaton Model and protein folding kinetics*

- Italian national conference on Statistical Physics and Complex Systems. Parma, 20 - 21 June 2007. Talk: Wako-Saitô-Muñoz-Eaton model and protein folding kinetics

**Attended Schools and Training Visits**

- International School on Statistical Physics Approaches to Systems Biology. Havana, 4 - 13 February 2019

- 2-month visit in the group of Prof. Roberto Mulet. University of Havana, Department of Theoretical Physics, 18 December 2018 - 18 February 2019

- International School on Multidisciplinary Approaches to Economic and Social Complex Systems. Siena, 27 June - 3 July 2010

- 3-month visit in the group of Prof. Paolo De Los Rios. Ecole Polytechnique Fédérale de Lausanne, Laboratory of Statistical Biophysics, 1 May - 31 July 2007

- International School of Physics "Enrico Fermi" on Protein Folding and Drug Design. Varenna (Lecco), 4 - 14 July 2006

- Séminaire Transalpin de Physique on Non-Equilibrium Statistical Mechanics. Champex-Lac (Entremont District), 5 - 11 March 2006

**Institutional Responsibilities**

- PhD student representative. Polytechnic University of Turin, Department of Physics, January 2006 - December 2008

**Positions of Trust**

- Reviewer for Physical Review E, Europhysics Letters, and Journal of Statistical Mechanics: Theory and Experiment

**Supervision Activity**

- Co-Supervisor of Master student Luca Pertile. University of Padua, October 2011 - April 2012. Thesis title: *Calibration of self-similar strongly correlated stochastic processes on the basis of a single time series*

- Co-Supervisor of Master student Stefano Ruzza. University of Turin, January 2015 - October 2015. Thesis title: *Inferenza statistica e criticità*

**Teaching**

- Regular lecturer in Continuum Mechanics and Fluid Dynamics in the International Master of Science programme in Physics of Complex Systems at Polytechnic University of Turin. Polytechnic University of Turin, May 2013 - May 2017

- Tutor in Classical Mechanics. Polytechnic University of Turin, January 2006 - December 2008

**Software Skills**

- Confident user of Linux, Fortran, Matlab, and Latex

**Language Skills**

- Italian (native) and English (fluent)

Data 14/07/2020 Luogo Torino