

CURRICULUM VITAE

ELENA AGLIARI

GENERAL INFORMATION

Current position	Research Fellow (RTD-A) Department of Mathematics, Sapienza University, Rome, Italy
Web-Page	http://www.mat.uniroma1.it/people/agliari
Spoken Languages	Italian (native), English (fluent), French (basic), German (basic)
Orcid-ID	0000-0002-5121-3511

EDUCATION AND QUALIFICATION

- July 2018: **National Scientific Qualification in Theoretical Physics of Fundamental Interactions** (02/A2) as Associate Professor (unanimous decision of the Committee)
- December 2016: **Qualification as Researcher** (ricercatore III livello a tempo indeterminato) in **Applied Mathematics** at CNR (Centro Nazionale delle Ricerche), prot. 368.15
- December 2013: **National Scientific Qualification in Mathematical Physics** (01/A4) as Associate Professor (unanimous decision of the Committee)
- December 2013: **National Scientific Qualification in Theoretical Physics of Matter** (02/B2) as Associate Professor (unanimous decision of the Committee)
- March 2007: **Ph.D. diploma in Physics** at Department of Physics, University of Parma
- March 2004: **Master Degree in Physics** at Department of Physics, University of Parma (final grade: 110/110 lode)
- July 1999: **High School Diploma** at Liceo Scientifico Statale “G. Ulivi” in Parma (final grade 100/100 lode)

ACCADEMIC APPOINTMENTS

- June 2015 - present: **Research Fellow** (RTD-A, **SSD MAT/07**) at Mathematics Department, **Sapienza University**, Rome, Italy (3 year contract extended 2 more years)
- March 2015 - May 2015: **Assistant Professor** at Engineering Department, **University Campus Bio-Medico**, Rome, Italy
- November 2014: **Research guest** at Mathematics Department, **University of São Paulo** (Brazil)
- March 2014 - September 2014: **Research fellowship** at Physics Department, **Sapienza University of Rome** (Italy)
- December 2010 - November 2013: **Researcher Associate** and **local Coordinator** for the project “Dynamics and statistical mechanics of lymphocyte networks below the percolation threshold”, within the MIUR program **FIRB** (Futuro In Ricerca) prot. RBF08EKEV [National Coordinator A. Barra (Sapienza University of Rome)], at Physics Department, University of **Parma** (Italy)
- 2010-2011: several periods spent as **Research Guest** at Laboratoire de Physique Théorique de la Matière Condensée, Université Pierre et Marie Curie, **Paris** (France) for collaboration with the research group led by O. Bénichou
- 2009-2013: several periods spent as **Researcher Guest** at **Sapienza University of Rome** (Italy) for collaboration with the research group “Complex Statistical Mechanics” led by F. Guerra
- 2009-2011: several periods spent as **Researcher Guest** at Albert-Ludwigs-Universität, **Freiburg** (Germany) for collaboration with the research group “Theoretical Polymer Physics” led by A. Blumen
- December 2008 – November 2010: **Post-doc** position (**Assegno di Ricerca**) for researches on “*Transport and Diffusion on complex structures*”, at Physics Department, University of **Parma** (Italy)
- February 2008 – November 2008: **Post-doc** fellowship from “**Fondazione Angelo della Riccia**” for investigations on “*Coherent and incoherent dynamics on discrete structures*”, at Albert-Ludwigs-Universität, **Freiburg** (Germany)
- January 2007 – January 2008: **Post-Doc** position (Borsa di Studio) for researches on “*Transport models for spin systems on complex topologies*”, at Physics Department, University of **Parma** (Italy)

MAIN RESEARCH TOPICS

• Mathematical methods for neural networks and artificial intelligence

Rigorous investigations on the Hopfield network (i.e., the standard model for associative retrieval) and on the Boltzmann machine (i.e., the standard model for learning) via statistical-mechanics techniques (e.g., smooth cavity field, multiple stochastic stability, random overlap structures, non-linear PDE approaches, interpolating replica trick, replica symmetry breaking). Development of a fluctuation theory for the order parameters to control analytically phase transitions. Extensions to more sophisticated embeddings (non-mean-field topologies and multi-species models) toward a rationale for deep learning.

• Statistical mechanics of complex systems and their applications

Rigorous investigations on the role of disorder and of topology in the emerging properties of statistical-mechanics models (e.g., spin models, biochemical networks, social systems). To this task the development of mathematical models and methods is required, possibly combining standard techniques of statistical mechanics with tools stemming from different fields such as cybernetics (e.g., transfer functions theory, Laplace transforms, Fourier analysis) and graph theory (e.g., percolation and rewiring processes, centrality and clustering measures).

• Random walks (classical and quantum) in inhomogeneous topologies

Rigorous solution of first-passage problems in low-dimension and/or non-exactly-decimable structures, possibly accounting for memory effects and splitting between local and average phenomena. Extension of the mean-field techniques for the treatment of processes defined in restricted geometries where the mixing hypothesis does not hold. These results were used in two main areas: "search strategies" and "reaction diffusion".

Quantum algorithms for searching problems.

TEACHING ACTIVITY

- A.Y. 2017/18, "**Mathematics for Artificial Intelligence**" Reading course for the PhD programme in Mathematics at University Sapienza of Rome (Italy) - **Lecturer**
- A.Y. 2016/17, 2017/18, "**Mathematical Methods and Models for the Environment**" at University Sapienza of Rome (Italy) - **Lecturer**
- A.Y. 2015/16, "**Mathematical and Numerical Methods in Biology**" at University Sapienza of Rome (Italy) - **Lecturer**
- A.Y. 2014/15, "**Mechanics and Thermodynamics**" at University Campus Bio-Medico of Rome (Italy) - **Co-Lecturer**
- January 2015, "**Random Walks, diffusion and statistical mechanics**" at CIRM school for the Institut Henri Poincaré trimester on "Disordered Systems, Random Spatial Processes and their Applications", Marseille (France) - **Invited Lecturer**
- December 2014, "**Modelling the complexity of the adaptive immune response**" for researchers and PhD students at Institut d'Études Avancées IMERA, Marseille (France) - **Invited Lecturer**
- A.Y. 2012/13, "**Physics of Complex Systems**", University of Parma (Italy) - **Lecturer**
- A.Y. 2010/11, "**Mathematical Methods for Arts II**", Politecnico "Scientia et Ars" (Italy) - **Lecturer**
- A.Y. 2010/11, "**Dynamical Systems**", University of Parma (Italy) - **Teaching Assistant**
- A.Y. 2007/08, 2008/09, 2009/10, "**Physics I**", Telematic University "San Raffaele" (Italy) - **Lecturer**
- A.Y. 2006/07: "**Complements of Quantum Physics**", University of Parma (Italy) - **Teaching Assistant**
- A.Y. 2005/06, 2006/07: "**Statistical Physics I**", University of Parma (Italy) - **Teaching Assistant**
- A.Y. 2004/05, 2006/07: "**Calculus III**", University of Parma (Italy) - **Teaching Assistant**

SUPERVISION OF STUDENTS

Since 2009 I have (co)-supervised:

4 students for the Bachelor Thesis

12 students for the Master Thesis

4 PhD students

1 student for Stage abroad

GRANTS AS PRINCIPAL INVESTIGATOR

- 2018 - "Progetto Giovani" 2018 from GNFM (Gruppo Nazionale di Fisica Matematica) to lead investigations on "**Approcci rigorosi al Deep Learning**" - 1.5 k€
- 2016 - "Progetto Giovani" 2016 from GNFM (Gruppo Nazionale di Fisica Matematica) to lead investigations on "**Statistical Mechanics of Deep Learning**" - 2 k€

- 2014 - “Progetto Giovani” 2014 from GNFM (Gruppo Nazionale di Fisica Matematica) to lead investigations on “**Molecular Parallel Processing: Rigorous results from Disordered Statistical Mechanics and Theory of Underpercolated Graphs**” - 2 k€
- 2012 - Academic scientific fundings from the University of Parma (maximum rank) - 2 k€
- 2010/11 - “Angelo della Riccia” grant to lead investigations on “**Reaction-Diffusion processes with applications to immune networks**” - 4 k€
- 2010/13 - FIRB (prot. RBFR08EKEV) for the project “**Dynamics and statistical mechanics of lymphocyte networks below the percolation threshold**” in collaboration with Sapienza University of Rome - 480 k€
- 2007/8 - “Angelo della Riccia” grant to lead investigations on “**Coherent and Incoherent Dynamics on discrete structures**” - 11 k€

GRANTS AS PARTICIPANT

- 2017 - **Fondi Ateneo Sapienza** on “*Modelling complex systems in the digital era*” (prot. RG11715C7CC31E3D); coordinator: Vittorio Loreto (Sapienza University of Rome).
- 2016 - **Fondi Ateneo Sapienza** on “*Mathematical-physics methods for evolution problems*” (prot. RM116154CD9961A3); coordinator: Dario Benedetto (Sapienza University of Rome).
- 2013 - **Progetto Giovani** from GNFM (Gruppo Nazionale di Fisica Matematica) on “*Statistical mechanics for molecular parallel processing*”; coordinator: Adriano Barra (Sapienza University of Rome).
- 2013 - **Spinner project** on “*Applications of inverse problems in bio-medical and public-health contexts*” supported by regione Emilia-Romagna; coordinator: Luca Zanni (University of Modena and Reggio).
- 2012 - **Fondi Ateneo Sapienza** on “*Application of statistical mechanics of complex systems to biological phenomena*”; coordinator: Adriano Barra (Sapienza University of Rome).
- 2011 - **Fondi Ateneo Sapienza** on “*Comparison between theory and experiment for complex statistical mechanics applied to the immune system*”; coordinator: Adriano Barra (Sapienza University of Rome).
- 2010, 2011, 2012 - participation to “**iniziativa specifica TO61**” on “*Biological applications of theoretical physics methods*” supported by Commissione IV of INFN; national coordinator: Michele Caselle (University of Torino).
- 2008 - **PRIN** (Progetti di Ricerca di interesse Nazionale) on “*Disorder and non-linearity in classical and quantum transport*”; national coordinator: Roberto Livi (University of Florence).

EDITORIAL BOARD MEMBERSHIP

- 2018 Invited **Guest Editor** for the “**Journal of Physics A: Mathematical and Theoretical**” special issue on “**Statistical Mechanics of Machine Learning**”.
- Since 2018 Member of the **Editorial Board** for “**Heliyon**” (Elsevier) [Mathematics section].
- Since 2018 Member of the **Editorial Board** for “**Frontiers in Physics**”.
- Since 2017 Member of the **Advisory Panel** for the “**Journal of Physics A: Mathematical and Theoretical**” (IOP).
- Since 2016 member of the **Scientific Committee** of “**Scienze & Ricerche**” [Mathematics section].
- 2015 **Editor** (with B. Tirozzi, G. Montani, A. Barra, and N. Carlevaro) for the volume “**Theory and Applications in Mathematical Physics**”, World Scientific Publishing .

SOCIETY MEMBERSHIPS, AWARDS AND HONORS

- 2018 **Invited contribution** on “**Multilayer Networks**” for the *New Journal Physics*.
- “**Outstanding Reviewers Awards**” from the *Journal of Physics A: Mathematical and Theoretical*, “in recognition of the high quality and timeliness of your reviews” (2016).
- 2016 **Invited topical review** on “**Looking at the immune System with Statistical Mechanics Glasses**” for the *Journal of Physics A: Mathematical and Theoretical*.
- From January 2013: member of **INDAM-GNFM** (Istituto Nazionale di Alta Matematica - Gruppo Nazionale di Fisica Matematica).
- October 2009 - November 2013: member of **INFN** (Istituto Nazionale Fisica Nucleare).
- Best student of the A.Y. 2002/03, Department of Physics, University of Parma.
- Several papers that I (co-)authored have been awarded by journal’s Editors and inserted in special collections. In particular, in the last five years:
 - E. Agliari, et al., *Retrieving infinite numbers of patterns in a spin-glass model of immune networks* (Europhys. Lett., 2017), selected for **Editor’s Choice** (2017) - Ref[68] in the full list of publications

- E. Agliari, et al., *Retrieval Capabilities of Hierarchical Networks: From Dyson to Hopfield* (Phys. Rev. Lett., 2015), selected for **Europhysicsnews** (46/2, 2015) - Ref[54] in the full list of publications
- E. Agliari, et al., *Meta-stable states in the hierarchical Dyson model drive parallel processing in the hierarchical Hopfield network*, selected by IOP for “**Highlights - A collection of outstanding research published in 2015**” and chosen for cover image by J. Phys. A (2015) - Ref[53] in the full list of publications
- E. Agliari et al., *Immune networks: multitasking capabilities near saturation*, selected by IOP for “**Highlights - A collection of outstanding research published in 2013**” - Ref[46] in the full list of publications.

SUMMARY OF SCIENTIFIC ACHIEVEMENTS

	Web Of Science	Source Scopus	Google Scholar
International Referred Publications	73 (since 2005)	72 (since 2005)	76 (since 2005)
Scientific Book (chapters)		3 (since 2010)	3 (since 2010)
International Referred Proceedings	3 (since 2014)	4 (since 2014)	8 (since 2007)
Total Citations	893	945	1295
Average Citations per Product	11.8	12.0	14.9
Normalized number of citations	68.7	72.7	99.6
H index	15	15	20
Contemporary H index	11	12	15
Normalized H index	1.4	1.4	1.8
Total Impact Factor		183.81	-
Invited Seminars and Talks in Workshops		35	
Invited lecturer for PhD schools/programs		3	
Research Gate Score		34.9 (93th percentile)	

ACADEMIC DUTIES

- A.Y. 2017/18: Member of the Committee for Orientation and Placement for the courses “Mathematics” and “Mathematics for Applications”, Sapienza University of Rome
- A.Y. 2016/17: Member of the Committee for Quality Managing and Assurance (Gestione dell’Assicurazione Qualità) for the course “Environmental Monitoring and Recovery”, Sapienza University of Rome
- September 2016: Room President for the admission test (Science), Sapienza University of Rome
- A.Y. 2016/17, 2017/18: Tutor for the Master course “Environmental Monitoring and Recovery”, Sapienza University of Rome

SCHOOLS ATTENDED

- “**XLI Summer School on Mathematical Physics**”, 05-10 September 2016, Ravello (Italy)
- “**XXXIX Summer School on Mathematical Physics**”, 15-27 September 2014, Ravello (Italy)
- “**Boulder school for condensed matter and material physics**” on “Non-equilibrium Statistical Mechanics: Fundamental Problems and Applications”, 6-24 July 2009, Boulder University, Colorado (USA)
- “**École d’Été de Physique Théorique**” - session 85: “*Complex Systems*”, 3-28 July 2006, Université Joseph Fourier, Les Houches (France)
- “**International Summer School**” on “*Fundamental Problems in Statistical Physics XI*”, 4-17 September 2005, Katholieke Universiteit Leuven, European Centre La Foresta, Leuven (Belgium)
- “**Condensed Matter Summer School**”, organized by INFM and ISI Foundation on “*Single molecule Biophysics*” and “*Non-Equilibrium systems: the problem of turbulence in fluids and plasma*”, 3-28 September 2004, Villa Gualino, Torino (Italy)
- “**International School of Theoretical Physics**”, organized by INFN, 31 August - 4 September 2004, Centro S. Elisabetta, Parma (Italy)

POPULARISATION OF SCIENCE

- E. Agliari, A. Barra, “Elementi di processazione di informazione nei sistemi biologici ed artificiali”, *Scienze&Ricerca* 50, 28-35 (2017)
- Collaboration to the project “Lauree Scientifiche” for high school students, at Sapienza University of Roma, Edition 2017
- A. Barra, E. Agliari, “Le reti del sistema immunitario da una prospettiva di meccanica statistica”, *Scienze&Ricerca* 34, 59-66 (2016)
- Collaboration to the project “La notte dei ricercatori” at University of Parma, 27 September 2013
- Invited talk “Scientific Careers” for high school students, Liceo Scientifico Statale “Giacomo Ulivi”, Parma, Editions 2007, 2010
- Invited talk “The role of a scientist” for undergraduate and high-school students, Centro S. Elisabetta, Parma 2007
- Collaboration to the project “Lauree Scientifiche” for high school students, at University of Parma, Editions 2006, 2007, 2010-12
- Laboratory “Meraviglie della Scienza. La cucina scientifica” at Festival della Scienza, Genova, 26 October – 7 November 2004

ORGANIZED WORKSHOP

- Workshop “**Women of Mathematics**”, 07-21 December 2016, Sapienza University of Rome, Italy (co-organized with G. Basile, D. Benedetto, A. D’Orazio, A. Garroni, C. Malvenuto et al.)
- Workshop “**Mathematical Physics: Theory and Applications**”, 15-17 September 2014, Sapienza University of Rome, Italy (co-organized with A. Barra)
- ECCS satellite meeting “**Modeling the complexity of the immune system**”, 19 September 2013, Barcelona, Spain (co-organized with A. Annibale, A. Barra and A.C.C. Coolen)
- **XVIII Convegno Nazionale di Fisica Statistica e dei Sistemi Complessi**, 24-26 June 2013, University of Parma, Italy (co-organized with P. Buonsante, R. Burioni, D. Cassi, A. Vezzani)
- Workshop “**Physicists’ investigations in immunology**”, 15 November 2012, Sapienza University of Rome, Italy (co-organized with A. Barra)
- **XVII Convegno Nazionale di Fisica Statistica e dei Sistemi Complessi**, 20-22 June 2012, University of Parma, Italy (co-organized with P. Buonsante, R. Burioni, D. Cassi, A. Vezzani)

INVITED SEMINARS AND CONTRIBUTIONS IN WORKSHOPS

- 1-26 July 2019: “Predictability and control of evolution”, Nordita, Stockholm (Sweden), invited talk “**TBA**” [scheduled]
- 13-18 October 2018: “Venice Meeting on Fluctuations in small complex systems IV”, Palazzo Franchetti, Venice (Italy), invited talk “**TBA**” [scheduled]
- 25-27 June 2018: “CONES2018: Frontiers of Non-Equilibriums Science”, King’s College, London [declined]
- 20 June 2018: Invited seminar “**Statistical inference tools to assess leukocyte migratory ability**”, CNR Nanotec, Lecce (Italy)
- 28 May - 01 June 2018: “Search and problem solving by random walks: drunkards vs quantum computers”, Physikzentrum Bad-Honnef (Germany), invited talk “**Search and Diffusion of Leucocytes on Lab-On-Chip**”
- 25 April 2018: “AI days in Northumbria”, Northumbria University, Newcastle (United Kingdom), invited talk “**Neural Networks from a stochastic dynamics perspective**”
- 20 February 2018: “Statistical Mechanics and Applications VIII”, Dipartimento di Matematica, Università di Bologna (Italy), invited talk “**Dreaming and Unlearning in Neural Networks**”
- 4-6 May 2017: Invited talk “**Statistical Mechanics of learning and retrieval**”, Assemblée GNFM, Montecatini (Italy)
- 18-21 April 2017: “Critical Transitions in Complex Systems”, University of Salento (Italy), invited talk “**Criticality in Graphs**”
- 7 April 2017: Invited seminar for Mathematical Models for Applications (MoMA) “**Neural Networks from a Statistical Mechanics perspective**”, Department of Mathematics, Sapienza University of Rome (Italy)
- 13 December 2016: Invited seminar for Numerical Analysis “**Analytical and Numerical Approaches to study Free-energy Minima of Associative Recurrent Neural Networks**”, Department of Mathematics, Sapienza University of Rome (Italy)
- 17-18 November 2016: “Mathematical Models for Quantum and Classical Mechanics”, Mathematic Department, University of Florence (Italy), invited talk “**Absorption and collision in branched structures**”
- 11 March 2016: Invited seminar “**Topological and Statistical-Mechanics properties of Dyson hierarchical systems**”, Institut Non Linéaire de Nice, Sophia-Antipolis (France)
- 17 December 2015: Invited seminar “**Information processing in biochemical networks**”, Computational Neuroscience

Laboratory, École Polytechnique Fédérale de Lousanne, Lousanne (Switzerland)

- 3-8 August 2015: "XIX Brazilian School of Probability", São Sebastião-SP, (Brazil), invited talk **"Statistical mechanics of hierarchical networks"**
- 11 March 2015: "Workshop on Fractional Calculus and its Applications", Mathematic Department, University of Roma Tre, Roma (Italy), Invited talk **"Lévy flights with absorption and collisione in combs"**
- 9 January 2015: Invited seminar **"Biological information processing on hierarchical and scale free networks"**, at Institut de Neurosciences des Systèmes, Aix-Marseille Université, Marseille (France)
- 5-7 November 2014: "4th Workshop in Stochastic Modeling", Mathematic Department, University of São Paulo, São Carlos (Brazil), Invited talk **"Epidemic spreading in inhomogeneous structures"**
- 4 April 2014: Invited seminar **"The infinite collision property on finite, random combs"**, Department of Mathematics, Sapienza University of Rome (Italy)
- 16-20 September 2013: "European Conference on Complex Systems", Barcelona (Spain), invited talk **"Anergy and parallel processing in spin glass models of immune networks"**
- 29 July - 1 August 2013: "Classical and Quantum transport in Complex Networks", Bad-Honnef (Germany), invited talk **"First-passage phenomena in branched structures"**
- 3-8 June 2013: "Search and Exploration III", Cargèse (France), Invited talk **"Collisions and absorption on branched structures"**
- 21 February 2013: Invited seminar **"A Statistical mechanics perspective on Immune Networks"**, at NORDITA, Stockholm (Sweden)
- 3 December 2012: Invited seminar **"The statistical mechanics of collective behaviours in chemical kinetics"**, at Albert-Ludwigs-Universitaet, Freiburg (Germany)
- 21 February 2012: Invited seminar **"A Statistical mechanics perspective on Immune Networks"**, at SISSA, Trieste (Italy)
- 1 December 2010: Invited seminar **"A Hebbian approach to complex network generation and applications in theoretical immunology"**, Physics Department, University of Pisa (Italy)
- 13 July 2010: Invited seminar **"Statistical physics approach to Immune Idiotypic Networks"**, at Soft Matter and Biophysics Department, Ludwig-Maximilians-Universitaet München, (Germany).
- 2-5 June 2010: "3rd Black Forest Focus on Soft Matter", Breisach (Germany), invited talk: **"Effects of Inhomogeneity on classical and quantum transport"**
- 15-20 November 2009: "Statistical Mechanics on Random Structures", Banff International Research Station, Banff (Canada), invited talk: **"The autopoietic immune system: a statistical physics perspective"**
- 5-6 March 2009: "Workshop on Statistical Mechanics and Applications III", Mathematics Department, University of Bologna, invited talk **"Diffusive Strategies in Group Competition"**
- 16-28 July 2008: "Workshop on Statistical Mechanics and Applications II", Eurandom, Eindhoven (The Netherlands), invited talk **"Non-canonical Dynamics for the Ising model on random structures"**
- 10-14 March 2008: "YEP (Young European Probabilists) V", Eurandom, Eindhoven (The Netherlands), invited talk **"Diffusive Thermal Dynamics for the Ising model on the Erdős-Rényi random graph"**
- 15 March 2007: Invited seminar **"Autocatalytic Reaction in Restricted Geometries: Extended Mean-Field Treatment and applications to Social Systems"**, at Brunel University, London (UK)
- 14-15 December 2006: "Informal Meeting on Statistical Physics", SISSA, Trieste (Italy), invited talk **"Statistical models of binary reactions among Diffusing particles"**
- 21-23 June 2006: "XI Convegno Nazionale Fisica Statistica", Physics Department, University of Parma (Italy), invited talk **"Efficiency of Information Spreading in a population of diffusing agents"**

OTHER CONTRIBUTIONS IN WORKSHOPS

- 5-7 October 2018: "Assemblea Scientifica del Gruppo Nazionale di Fisica Matematica", at Montecatini Terme (Italy), talk: **"Apprendimento, Consolidamento e Rimozione"** [scheduled]
- 26-28 June 2017: "Bio-Math Modelling Workshop (MOBI-2017)", at Istituto Nazionale di Alta Matematica, Rome (Italy), talk: **"The (biochemical) molecular interactions from a cybernetic perspective"**
- 01-02 October 2015: "Mathematical Models in Social Dynamics", at Politecnico di Torino (Italy), talk: **"The role of migration is economic complexity"**
- 22-23 May 2014: "Biophysics@Rome2014", at CNR Tor Vergata (Italy), talk: **"Statistical mechanics unveils collective behaviours in biochemistry"**
- 15-17 May 2014: "Assemblea Scientifica del Gruppo Nazionale di Fisica Matematica", at Montecatini Terme (Italy), talk: **"Collective behaviours: from biochemical kinetics to cybernetics"**

- 21-23 September 2011: “XV Workshop on Statistical Mechanics and non-perturbative Field Theory”, at Physics Department, University of Bari (Italy), talk: **“Performance and breakdown of the immune system from a statistical mechanics perspective”**
- 9-11 September 2010: “BioPhys 2010”, at Arcidosso (Italy), sponsored talk **“Statistical physics approach to Immune Idiotypic Networks”**
- 28-30 May 2009: “NET 2009 Evolution and Complexity”, Sapienza University of Rome (Italy), poster contribution: **“Group Competition and Consensus Spreading”**
- 26-29 August 2007: “Diffusion Fundamentals II”, organized by University of L’Aquila, UCL (University College London) and University of Leipzig in L’Aquila (Italy), poster contribution **“Autocatalytic reaction-diffusion process in restricted geometries”**
- 16-18 July 2007: “Fluctuation and Dissipation Phenomena in Driven Systems far from Equilibrium”, Max Planck Institute, Dresden (Germany), poster contribution **“Heat conduction in a two-dimensional Ising model”**
- 17-20 September 2006: “XXIV Convegno di Fisica Teorica e Struttura della Materia”, organized by University of Trento, Levico Terme (Italy), poster contribution **“Universal Features of Information Spreading”**

SCIENTIFIC COMMITTEES, REVIEWER ACTIVITY

Reviewer for the following project founding institutions:

IMéRA: Institut d’études avancées d’Aix-Marseille (Foundation of Université d’Aix-Marseille)
 Deutsche Forschungsgemeinschaft (German Research Foundation)
 Swiss National Science Foundation
 Romanian Research Programme
 United Arab Emirates University Research Office
 Czech Science Foundation

Member of the following workshop program committees:

CompleNet 2014 (5th Workshop on Complex Networks)
 Socio-Economic Dynamics: Physics-based Agent Models to go beyond the representative agent paradigm (Satellite Meeting of ECCS’14)

Reviewer for international scientific journals:

Since 2006 I have served as reviewer for more than 30 international scientific journals (ISI) in the area of applied mathematics, mathematical physics and theoretical physics.

FULL LIST OF PUBLICATIONS (ISI)

78. A. Fachechi, E. A., A. Barra, *Unlearning in neural networks*, to be submitted to *Neur. Net.*
77. E. A., A. Barra, B. Tirozzi, *Boltzmann Machines: self-averaging properties and thermodynamic limit*, submitted to *Rev. Math. Phys.*
- 2018**
76. E. A., D. Migliozi, D. Tantari, *Non-Convex Multi-species Hopfield models*, *J. Stat. Phys.* In press (2018)
75. E. A., A. Barra, P. Contucci, A. Pizzoferrato, C. Vernia, *Social interaction effects on immigrant integration*, *Palgrave Communications* 4, 55 (2018)
74. E. Agliari, A. Barra, G. Landolfi, S. Murciano, S. Perrone, *Complex Reaction Kinetics in Chemistry: A Unified Picture Suggested by Mechanics in Physics*, *Complexity* 2018, 7423297 (2018)
- 2017**
73. E. A., A. Pachon, P. Rodrigues, F. Tavani, *Phase Transition for the Maki–Thompson Rumour Model on a Small-World Network*, *J. Stat. Phys.* 169, 846 (2017)
72. L. Fusaro, S. Mereu, E. Salvatori, E. Agliari, S. Fares, F. Manes, *Modeling ozone uptake by urban and peri-urban forest: a case study in the Metropolitan City of Rome*, *Environ. Sci. Pollut. Res.* (2017)
71. E. Agliari, A. A. Barra, D. Tantari, C. Longo, *Neural Networks Retrieving Boolean Patterns in a Sea of Gaussian Ones*, *J. Stat. Phys.* 168, 1085 (2017)
70. J. Peng, E. A., *Scaling laws for diffusion on (trans)fractal scale-free networks*, *Chaos* 27, 083108 (2017)
69. E. Biselli, E.A., A. Barra, F. R. Bertani, A. Gerardino, A. De Ninno, A. Mencattini, F. Mattei, G. Schiavoni, V. Lucarini, E. Vecchelli, G. Kromer, C. Di Natale, E. Martinelli, L. Businaro, *Organs on chip approach: a tool to evaluate cancer-immune cells interactions*, *Sci. Rep.* (2017)
68. E. A., A. Annibale, A. Barra, ACC Coolen, D. Tantari, *Retrieving infinite numbers of patterns in a spin-glass model of immune networks*, to appear on *Europhys. Lett.* 117, 28003 (2017); selected by IOP

67. E. A., F. Tavani, *The exact Laplacian spectrum for the Dyson hierarchical network*, Sci. Rep. 7, 39962 (2017)
- 2016**
66. E. A., A. Barra, L. Dello Schiavo, A. Moro, *Complete integrability of information processing by biochemical reactions*, Sci. Rep. 6, 36314 (2016)
65. E. A., A. Barra, A. Galluzzi, F. Rovira, D. Tantari, *In Assessing the role of migration as trade-facilitator using the statistical mechanics of cooperative systems*, Palgrave Communications 2, 16021 (2016)
64. E. A., D. Cassi, L. Cattivelli, F. Sartori, *Two-particle problem in comblike structures*, Phys. Rev. E 93, 052111 (2016)
63. F. Tavani, E. A., *First-passage phenomena in hierarchical networks*, Phys. Rev. E 93, 022133 (2016)
- 2015**
62. E. A., A. Barra, A. Galluzzi, M. Javarone, A. Pizzoferrato, D. Tantari, *Emerging heterogeneities in Italian customs and comparison with nearby countries*, PLoS One 0144643 (2015)
61. L. Cattivelli, E. A., F. Sartori, D. Cassi, *Lévy Flights with power law absorption*, Phys. Rev. E 92, 042156 (2015)
60. J. Peng, E. A., Z. Zhang, *Exact calculations of first-passage properties on the pseudofractal scale-free web*, Chaos 25, 073118 (2015)
59. E. A., A. Barra, A. Galluzzi, D. Tantari, F. Tavani, *Topological properties of hierarchical networks*, Phys. Rev. E 91, 062807 (2015)
58. M. Bellingeri, E. A., D. Cassi, *Optimization strategies with resource scarcity: From immunization of networks to the traveling salesman problems*, Mod. Phys. Lett. B 1550180 (2015)
57. E. A., F. Sartori, L. Cattivelli, D. Cassi, *Hitting and trapping times on branched structures*, Phys. Rev. E 91, 052132 (2015)
56. E. A., M. Altavilla, A. Barra, L. Dello Schiavo, E. Katz, *Notes on stochastic (bio)-logic gates: the role of allosteric cooperativity*, Sci. Rep. 5, 9415 (2015)
55. E. A., A. Barra, A. Galluzzi, F. Guerra, D. Tantari, F. Tavani, *Hierarchical neural networks perform both serial and parallel processing*, Neur. Net. 66, 22 (2015)
54. E. A., A. Barra, A. Galluzzi, F. Guerra, D. Tantari, F. Tavani, *Retrieval capabilities of hierarchical networks: From Dyson to Hopfield*, Phys. Rev. Lett. 114, 028103 (2015)
53. E. A., A. Barra, A. Galluzzi, F. Guerra, D. Tantari, F. Tavani, *Meta-stable states in the hierarchical Dyson model drive parallel processing in the hierarchical Hopfield network*, J. Phys. A 48, 015001 (2015); selected for cover image for the printed issue of J. Phys. A: Math. Theor. (volume 48 issue 1); selected by IOP
52. P. Sgrignoli, E. A., R. Burioni, A. Schianchi, *Instability and Network Effects in Innovative Markets*, Mathematics and Computers in Simulation 108, 260-271 (2015)
51. E. A., A. Barra, G. Del Ferraro, F. Guerra, D. Tantari, *Anergy in self-directed B lymphocytes: A statistical mechanics perspective*, J. Theor. Biol. 375, 21-31 (2015)
- 2014**
50. E. A., E. Biselli, A. De Ninno, G. Schiavoni, L. Gabriele, A. Gerardino, F. Mattei, A. Barra, L. Businaro, *Cancer-driven dynamics of immune cells in a microfluidic environment*, Sci. Rep. 4, 6639 (2014)
49. E. A., A. Barra, P. Contucci, R. Sandell, C. Vernia, *A stochastic approach for quantifying immigrant integration: the Spanish test case*, New J. Phys. 16, 103034 (2014)
48. E. A., A. Blumen, D. Cassi, *Slow encounters of particle pairs in branched structures*, Phys. Rev. E 89, 052147 (2014)
47. E. A., A. Barra, A. Galluzzi, M. Isopi, *Multitasking associative networks with neuronal threshold noise*, Neur. Net. 49, 19 (2014)
- 2013**
46. E. A., A. Annibale, A. Barra, A.C.C. Coolen, D. Tantari, *Immune networks: multi-tasking capabilities near saturation*, J. Phys. A 46, 415003 (2013); selected by IOP
45. E. A., A. Barra, R. Burioni, A. Di Biasio, G. Uguzzoni, *Collective behaviours: from biochemical kinetics to electronic circuits*, Sc. Rep. 3, 3458 (2013)
44. E. A., A. Annibale, A. Barra, A.C.C. Coolen, D. Tantari, *Immune networks: multi-tasking capabilities at medium load*, J. Phys. A 46, 335101 (2013)
43. E. A., A. Barra, S. Bartolucci, A. Galluzzi, F. Guerra, F. Moauro, *Parallel processing in immune networks*, Phys. Rev. E 87, 042701 (2013); selected for Kaleidoscope April 2013
42. E. A., A. Barra, A. D'Antoni, A. Galluzzi, *Parallel retrieval of correlated patterns: from Hopfield networks to Boltzmann machines*, Neur. Net. 38, 52 (2013)
41. E. A., L. Asti, A. Barra, R. Scrivo, R. Valesini, R.S. Wallis, *Application of Stochastic Modelling to Assess the Evolution of Tuberculous and Non-Tuberculous Mycobacterial Infection in Patients Treated with Tumor Necrosis Factor Inhibitors*, PLoS One 8, e55017 (2013)
- 2012**
40. E. A., A. Barra, A. Galluzzi, F. Guerra, F. Moauro, *Multitasking Associative Networks*, Phys. Rev. Lett. 109, 268101 (2012)

39. E. A., L. Asti, A. Barra, R. Burioni, G. Uguzzoni, *Analogue neural networks on correlated random graphs*, J. Phys. A 45, 365001 (2012)
38. E. A., A. Barra, F. Guerra, K. Gervasi-Vidal, *Can persistent Epstein-Barr virus infection induce chronic fatigue syndrome as a Pavlov reflex of the immune response?*, J. Biol. Dyn. 6, 740 (2012)
37. E. A., R. Burioni, G. Uguzzoni, *The true reinforced random walk with bias*, New J. Phys. 14, 063027 (2012)
36. E. A., A. Barra, R. Burioni, A. Di Biasio, *Notes on the p-spin glass studied via Hamilton-Jacobi and smooth cavity techniques*, J. Math. Phys. 53, 063304 (2012)
35. E. A., L. Asti, A. Barra, L. Ferrucci, *Organization and evolution of synthetic idiotypic networks*, Phys. Rev. E 85, 051909, (2012)
34. B. Meyer, E. A., O. Bénichou, R. Voiturez, *Exact calculations of first-passage quantities on recursive networks*, Phys. Rev. E 85, 026113 (2012)
33. A. Di Biasio, E. A., A. Barra, R. Burioni, *Mean-field cooperativity in chemical kinetics*, Theor. Chem. Acc. 131, 1104 (2012)
32. A. Barra, E. A., *A statistical mechanics approach to Granovetter theory*, Physica A 391, 3017 (2012)
- 2011**
31. E. A., M. Casartelli, A. Vezzani, *Slow relaxation in microcanonical warming of a Ising lattice*, Eur. Phys. J. B 84, 317 (2011)
30. E. A., A. Barra, F. Guerra, F. Moauro, *A thermodynamic perspective on immune capabilities*, J. Theor. Biol. 287, 48 (2011)
29. E. A., C. Cioli, E. Guadagnini, *Percolation on correlated random networks*, Phys. Rev. E 84, 031120 (2011)
28. E. A., A. Barra, *A Hebbian approach to complex-network generation*, Europhys. Lett. 94 10002 (2011)
27. E. A., *Trapping of continuous-time quantum walks on Erdős-Rényi graphs*, Physica A 390 1853 (2011)
26. E. A., A. Barra, F. Camboni, *Notes on ferromagnetic diluted p-spin model*, Rep. on Math. Phys. 68, 1 (2011)
25. A. Barra, E. A., *Equilibrium statistical mechanics on correlated random graphs*, J. Stat. Mech. P02027 (2011)
- 2010**
24. E. A., M. Casartelli, A. Vezzani, *Microscopic energy flows in disordered Ising spin systems*, J. Stat. Mech. P10021 (2010)
23. A. Barra, E. A., *Stochastic dynamics for idiotypic immune networks*, Physica A 389, 5903 (2010)
22. E. A., M. Casartelli, E. Vivo, *Metric characterization of cluster dynamics on the Sierpinski gasket*, J. Stat. Mech. P09002 (2010)
21. E. A., R. Burioni, P. Sgrignoli, *A two-populations Ising model on diluted random graphs*, J. Stat. Mech. P07021 (2010)
20. E. A., R. Burioni, A. Manzotti, *Effective target arrangement in a deterministic scale-free graph*, Phys. Rev. E 82, 011118 (2010)
19. A. Barra, E. A., *A Statistical mechanics approach to autopoietic immune networks*, J. Stat. Mech. P07004 (2010)
18. E. A., A. Blumen, O. Mülken, *Quantum-walk approach to searching on fractal structures*, Phys. Rev. A 82, 012305 (2010); selected for Vir. J. Quantum Inf./ Vol. 10/ Issue 7/ Algorithms and Computation and for Kaleidoscope July 2010
17. E. A., R. Burioni, P.L. Contucci, *A Diffusive Strategic Dynamics for Social Systems*, J. Stat. Phys. 139, 478 (2010)
16. E. A., A. Blumen, O. Mülken, *Continuous-Time quantum walks and trapping*, Int. J. Bif. Chaos, 20, 271 (2010)
15. E. A., R. Burioni, D. Cassi, F.M. Neri, *Word-of-Mouth and dynamical inhomogeneous markets: an efficiency measure and optimal sampling policies for the pre-launch stage*, IMA J. Manage. Math. 21, 67 (2010)
- 2009**
14. E. A., R. Burioni, *Random walks on deterministic scale-free networks: exact results*, Phys. Rev. E, 80, 031125 (2009)
13. E. A., M. Casartelli, A. Vezzani, *Energy transport in an Ising disordered model*, J. Stat. Mech. 07041 (2009)
- 2008**
12. E. A., A. Barra, F. Camboni, *Criticality in diluted ferromagnet*, J. Stat. Mech., 10003 (2008)
11. E. A., A. Blumen, O. Mülken, *Dynamics of continuous-time quantum walks in restricted geometries*, J. Phys. A, 41, 445301 (2008)
10. E. A., M. Casartelli, A. Vezzani, *Interacting random walkers and non-equilibrium fluctuations*, Eur. Phys. J. B, 65, 257 (2008)
9. E. A., *Exact mean first-passage time on the T-graph*, Phys. Rev. E, 77, 011128 (2008)
8. E. A., R. Burioni, D. Cassi, F.M. Neri, *Random walk on a population of random walkers*, J. Phys. A, 41, 015001 (2008)
- 2007**
7. E. A., M. Casartelli, A. Vezzani, *Configurations and observables in an Ising model with heat flow*, Eur. Phys. J. B, 60, 499 (2007)
6. E. A., R. Burioni, D. Cassi and F.M. Neri, *Autocatalytic reactions on low-dimensional substrates*, Theor. Chem. Acc. 118, 855 (2007)

5. E. A., R. Burioni, D. Cassi, F.M. Neri, *Universal features of information spreading efficiency on d-dimensional lattices*, Phys. Rev. E, 75, 021119 (2007); selected by Vir. J. Bio. Phys. Res./ Vol. 13/ Issue 5/ Information Transfer in Biological Systems

2006

4. E. A., R. Burioni, D. Cassi, F.M. Neri, *Efficiency of information spreading in a population of diffusing agents*, Phys. Rev. E 73, 046138 (2006); selected by Vir. J. Bio. Phys. Res./ Vol. 11/ Issue 9/ Information Transfer in Biological Systems
3. E. A., R. Burioni, D. Cassi, A. Vezzani, *Fractal geometry of Ising magnetic patterns: signatures of criticality and diffusive dynamics*, Eur. Phys. J. B, 49, 119 (2006)

2005

2. E. A., R. Burioni, D. Cassi, A. Vezzani, *Random walks interacting with evolving energy landscapes*, Eur. Phys. J. B, 48, 529 (2005)
1. E. A., R. Burioni, D. Cassi, A. Vezzani, *Diffusive thermal dynamics for the spin-S Ising ferromagnet*, Eur. Phys. J. B, 46, 109 (2005)

BOOKS

4. E. A., "A Random Walk in diffusion phenomena and statistical mechanics", book chapter in "Lecture Notes for Henri Poincare trimester", Cambridge University Press (2016)
3. E. A., D. Cassi, "First-passage phenomena on finite inhomogeneous networks", book chapter in "First-Passage Phenomena and Their Applications", R. Metzler, G. Oshanin, and S. Redner Eds., World Scientific Publishing, Singapore (2014)
2. E. A., *Diffusion with reaction and interaction: from condensed matter to social systems*, LAP LAMBERT Academic Publishing GmbH & Co. KG. Saarbrücken, Germany (2011)
1. E. A., A. Barra, R. Burioni, P. Contucci, *New perspectives in the equilibrium statistical mechanics approach to social and economic sciences*, book chapter in "Mathematical Modeling of Collective Behavior in Socio-Economic and Life-Sciences", G. Naldi, L. Pareschi, G. Toscani Eds., Birkhäuser Mathematics, Springer (2010)

PROCEEDINGS

8. E. A., A. Barra, F. Tavani, B. Tirozzi, *Motifs stability in hierarchical modular networks*, in "Theory and Applications in Mathematical Physics", World Scientific Publishing (2016)
7. E. A., A. Barra, A. Galluzzi, D. Tantari, F. Tavani, *A walk in the statistical mechanics formulation of neural networks. Alternative routes to Hebb prescription*, in "Proceedings of the International Conference on Neural Computation Theory and Applications (NCTA-2014)", SCITEPRESS (Science and Technology Publications, Lda) (2014)
6. R. Burioni, E. A., D. Cassi, *Excitations Transfer and Random Walks on Dynamic Contacts Networks*, in "Nonlinear Phenomena in Complex Systems: From Nano to Macro Scale", D. Matrasulov and H.E. Stanley Eds., Springer Series (NATO Science for Peace and Security Series C: Environmental Security) (2014)
5. E. A., A. Barra, A. Galluzzi, A. Pizzoferrato, D. Tantari, *Ferromagnetic Models for Cooperative Behavior: Revisiting Universality in Complex Phenomena*, in "Mathematical Models and Methods for Planet Earth", A. Celletti, U. Locatelli, T. Ruggeri and E. Strickland Eds., Springer INdAM Series (2014)
4. E. A., A. Barra, S. Franz, T. Sabetta, *Some Thoughts on the Ontogenesis in B-cell Immune Networks*, in "Managing complexity reducing perplexity. Mathematical modelling of biological system", G. Ajmone Marsan and M. Delitala Eds., Springer Heidelberg (2014)
3. E. A., A. Barra, R. Burioni, F. Camboni, P. Contucci, *Effective interactions in group competition with strategic diffusive dynamics*, Intellectual Archive Bulletin, 09/12 (2012)
2. E. A., A. Barra, R. Burioni, P. Contucci, *Acquaintance role for decision making and exchanges in social networks*, J. Dyses 2, no. 1, 34 (2009)
1. E. A., R. Burioni, D. Cassi, F.M. Neri, *Autocatalytic reaction-diffusion processes in restricted geometries*, Diffusion Fundamentals, 7, 1.1 (2007)

Roma, li 21 Agosto 2018

La dichiarante

