Curriculum Vitae et Studiorum

1. Personal Data:

1.1 Name: Alessandro Torcini

1.2 Date of Birth: June 22nd, 1961

1.3 Sex: Male

1.4 Living Address :

via Guizzelmi 16 I-59100 Prato (Italy)

phone: (++39) 320-0153534

1.5 Office Address :

Istituto dei Sistemi Complessi - CNR

via Madonna del Piano 10 I-50019 Sesto Fiorentino (Italy)

phone: (++39) 055 522-6620 fax: (++39) 055 522-6683

e-mail: alessandro.torcini@cnr.it

1.6 Present Employment :

Coordinator of the research group : "Dynamical Behaviour of Complex Systems"
Capo della Commessa MD.P02.017.001 : Comportamento Dinamico di Sistemi Complessi
Istituto dei Sistemi Complessi - CNR - Sesto Fiorentino (Italy)
Date of appointment: January, 1st, 2012

Researcher (Open-ended contract)
Ricercatore a Tempo Indeterminato - III Livello Professionale
Istituto dei Sistemi Complessi - CNR - Sesto Fiorentino (Italy)
Date of appointment: January, 1st, 2006

1.7 Previous Periods of Employment :

Period of employment: January, 14th, 2004 – December, 31st, 2005
Researcher (Open-ended contract)
Ricercatore a Tempo Indeterminato - III Livello Professionale
Istituto Nazionale di Ottica Applicata (INOA) - Firenze (Italy)

Period of employment: September, 01st, 2003 – January, 13th, 2004
Assegno di Ricerca INOA A/5/2003 – Research Fellowship
Collaboration with Dr. Antonio Politi (INOA)
Topics: Information processing in networks of globally coupled oscillators
Istituto Nazionale di Ottica Applicata (INOA) - Firenze (Italy)

Period of employment: May, 15th, 2003 – August, 31st, 2003
Contratto di collaborazione Coordinata e Continuativa - Fixed Term Contract
Collaboration with Dr. Antonio Politi (INOA)
Research Topics: Synchronization in spatially extended systems
Istituto Nazionale di Ottica Applicata (INOA) - Firenze (Italy)

Period of employment: November, 01st, 2001 – October, 31st, 2002
Contratto di collaborazione Coordinata e Continuativa – Fixed Term Contract
Collaboration with Dr. Franco Quercioli (INOA)
Research Topics: Modelization of the Mechanical Manipulation of Single Proteins
Istituto Nazionale di Ottica Applicata (INOA) - Firenze (Italy)

Period of employment: September, 01st, 2001 – December, 31st, 2002
Contratto di collaborazione Coordinata e Continuativa – Fixed Term Contract
Collaboration with Prof. Stefano Ruffo (Energetics Dept.)
Research Topics: Chaos and Localization in Classical and Quantum Mechanics
Department of Energetics – University of Firenze (Italy)

Period of employment: June, 23rd, 2001 – August, 31st, 2003
Physics Teacher for students of Secondary School
Employer: Italian Ministry for Public Education
8 hours per week - Part-time open-ended employment contract
Istituto Tecnico Industriale "T. Buzzi" – Prato (Italy)

Period of employment: July, 08th, 2000 – June, 22nd, 2001
Contratto di collaborazione Coordinata e Continuativa – Fixed Term Contract
Collaboration with Prof. Angelo Vulpiani (Physics Dept.)
Research Topics: Transport and Mixing in Turbulent Dynamical Systems
Department of Physics – University of Rome "La Sapienza" (Italy)

Period of employment: July, 08th, 1998 – July, 07th, 2000
INFM Post-Doc Fellowship in Physics
Fellowship awarded by the National Institute of Condensed Matter Physics (INFM)
Collaboration with Prof. Roberto Livi (Physics Dept.)
Research Topics: Protein Folding
Department of Physics – University of Firenze (Italy)

Period of employment: January, 08th, 1997 – July, 07th, 1998
MURST Post-Doc Fellowship in Applied Mathematics
Fellowship awarded by the Italian Ministry for the University and the Research (MURST)
Collaboration with Prof. Stefano Ruffo (Energetics Dept.)
Research Topics: Turbulence and Chaotic Phenomena
Department of Energetics – University of Firenze (Italy)

Period of Leave of Absence: October, 16th, 1996 – January, 07th, 1997

Period of employment: October, 15th, 1994 – October, 15th, 1996
Marie-Curie Post-Doc Fellowship in Physics
Fellowship awarded by the European Community
Human Capital & Mobility Programme (Individual Fellowship)
Collaboration with Prof. Dr. Peter Grassberger (Dept. Theoretical Physics)
Research Topics: Multifractal Analysis of Spatio-Temporal Chaos
Department of Theoretical Physics – University of Wuppertal (Germany)

Period of employment: November, 01st, 1993 – October, 14th, 1994
Physics Teacher for students of Secondary School
Employer: Italian Ministry for Public Education
18 hours per week - Full-time open-ended employment contract
Istituto Tecnico per Geometri "A.Gramsci" - Prato (Italy)

Period of employment: November, 01st, 1990 – October, 31th, 1993
MURST PhD Fellowship in Physics
Fellowship awarded by the Italian Ministry for the University and the Research (MURST)
PhD Advisor: Dr. Umberto Balucani (Istituto di Elettronica Quantistica - CNR)

Dissertation Topics: Microscopic Dynamics in Simple and Molecular Liquids
Department of Physics – University of Firenze (Italy)

1.8 Visiting professorships :

I have been visiting professor at the following institutions

- Physikalisch-Technische Bundesanstalt, Berlin (Germany) – October 2013
- Astronomy and Physics Department of Aarhus University (Denmark) – November 2012
- Physikalisch-Technische Bundesanstalt, Berlin (Germany) – August/September 2012
- Astronomy and Physics Department of Aarhus University (Denmark) – October-December 2011
- Astronomy and Physics Department of Aarhus University (Denmark) – April/May 2010
- Weierstrass Institute for Applied Analysis and Stochastics, Berlin (Germany) – April/May 2008
- Centre de Physique Theorique - Université de Marseille - Luminy (France) – September 2007
- Laboratoire des Systémes Chimiques Complexes - Université de Marseille - St. Jerome (France) – June 2002

Furthermore, I have been visiting scientist at the following institutions : Max Planck Institut für Physik komplexer Systeme - Dresden (Germany), Ecole Normale Superieure - Lyon (France), Erwin Schrödinger Institut - Wien (Austria), Institute for Nonlinear Science - La Jolla - California (USA).

2. Degrees, Assessments and Evaluations

2.1 Academic degrees :

PhD in Theoretical Physics during 1991-1993
Oral defense of the dissertation on Sept. 23rd, 1994
Ph.D. Advisor: Dr. Umberto Balucani (Istituto di Elettronica Quantistica)
Dissertation Topics: Microscopic Dynamics in Simple and Molecular Liquids
Department of Physics – University of Firenze (Italy)

Laurea (equivalent to MSc) in Theoretical Physics
Oral defense of the Thesis on Jan. 30th, 1990
Laurea Advisor: Dr. Antonio Politi (Istituto Nazionale di Ottica - Firenze)
Laurea Topics: Spatio-Temporal Chaos in One Dimensional Lattices
Laurea final evaluation: 110/110 cum Laude
Department of Physics – University of Firenze (Italy)

2.2 Habilitations :

Since 2015 Admitted in the french qualification lists for
Professor in Theoretical Physics Section 29 : Constituants Elementaires
Professor in Condensed Matter Section 28 : Milieux denses et matériaux

Since 2013- Admitted in the italian qualification lists (Abilitazione Scientifica Nazionale) for
Associated Professor in Theoretical Physics of the Fundamental Interactions 02/A2
Associated Professor in Theoretical Condensed Matter Theory 02/B2

2004-2010 National Evaluation of the Quality of my Research (VQR)
Evaluation : 6.8/7.0 points for 7 selected articles
6 of my scientific articles have been evaluated excellent (point 1.0)
1 of my scientific article has been evaluated good (point 0.8)

2008-2011 Admitted in the french qualification lists for
Professor in Theoretical Physics Section 29 : Constituants Elementaires

Professor in Condensed Matter Section 28 : Milieux denses et matériaux

1999-2006 Admitted in the french qualification list for
Professor in Theoretical Physics Section 29 : Constituants Elementaires

1995-2003 Admitted in the french qualification list for
Maitre de Conferences in Theoretical Physics Section 29 : Constituants Elementaires

2.3 Known Languages :

- *Italian* : native speaker
- *English* : reasonably good written and oral knowledge
- *German* : oral and written comprehension, reasonable oral expression
- *French* : oral and written comprehension at a good level, oral and written expression at a basic level

3. Scientific Achievements

3.1 Grants obtained within the last 10 years:

3.1.1 National funds :

2012-2015 CRISIS LAB – PNR 2012-2015
The project concerns interdisciplinary activities along the following research lines: Complexity, Economy and Financial crisis. The project involves ISC-CNR and the Institute for Advanced Studies in Lucca. The total funding amounts to 7 milions of euro, 270,000 euros for the ISC-CNR group in Sesto Fiorentino. I am the scientific and management responsible for the activity at ISC-CNR in Sesto Fiorentino.

2010-2015 Joint Italian-Israeli Laboratory in Neuroscience
I coordinate from January 2013 the Italian section of the recently established Joint Italian-Israeli Laboratory in Neuroscience, whose sections are located at the University of Tel Aviv (Israel) and at the Istituto dei Sistemi Complessi in Sesto Fiorentino (Italy). The responsibles of the Israeli section is Prof. E. Ben Jacob. Project duration: 5 years, the total funding amounts to 300,000 Euros, 100,000 Euros for the ISC-CNR group. The funds have been appropriated by the Italian Foreign Ministry.

2010-11 TRIL Fellowship
Individual Fellowship awarded to Dr. Aurelien Jiotsa Kenfack (Cameroon) within the programme Project Training and Research in Italian Laboratories of the ICTP in Trieste (Italy), responsible of the project. The total amount of the grant was 10,000 Euros and the duration 6 months.

2008-2010 RSTL project: Cooperative dynamics in quasi-one dimensional structures
Funds appropriated by the Consiglio Nazionale delle Ricerche (CNR) within the "Ricerca spontanea a tema libero" Programme, the total amount of the funds was 36,200 Euros and the duration of the project 24 months. I was the coordinator of the project.

2005 TRIL Fellowship
Individual Fellowship awarded to Dr. Aurelien Jiotsa Kenfack (Cameroon) within the programme Project Training and Research in Italian Laboratories of the ICTP in Trieste (Italy), responsible of the project Dr. A. Politi, I acted as co-responsible. The total amount of the grant was 16,000 Euros and the duration 12 months.

3.1.2 Funding from EU and other countries:

2016 Support for an Advanced Study Group from the Max-Planck Gesellschaft

The Max-Planck-Institut fuer Physik Komplexer Systeme of Dresden (Germany) has supported with 55,000 Euros the Advanced Study Group "From microscopic to collective dynamics in neural circuits" to be held in 2016 in Dresden. I am the Principal Investigator.

2012-2016 Marie Curie Actions - Initial Training Networks – No 289146 - NETT

Marie Curie FP7-PEOPLE-2011-ITN Project "NETT – Neural Engineering Transformative Technologies", coordinated by Prof. S. Coombes (University of Nottingham - UK) and involving 7 Academic Laboratories (including Imperial College - London, Dr. S. Schultz) and 10 Private Companies from nine european countries actively involved in research and development activities on Neural Engineering, Neuroscience and Computational Neuroscience. The total funding for the project amounts to 5.3 milions of Euros, 760,000 Euros for the italian ISC-CNR partner. I am the scientific and management responsible for the ISC-CNR group and the Director of Research of the Consortium.

2007-2010 Marie Curie Outgoing International Fellowship – No 04576 - STDP

Individual Fellowship within the European HRM Activity denominated "STDP - Spike time dependent plasticity" awarded to Dr. Thomas Kreuz (Germany). The project has been performed in part at Istituto dei Sistemi Complessi (1 year) and in part at the Institute of Nonlinear Science - UCSD - La Jolla - California (USA) (2 years). The total amount of the grant was 238,000 Euros and its duration 36 months. I have been scientific and management co-responsible together with Dr. A. Politi.

2009 ESF Grant # 2110 to support a Science Meeting

European Science Foundation support for the organization of the workshop "Bio Struct09 - Unraveling the structure of bio molecules : from nonequilibrium statistical mechanics to mechanical manipulation" held in Sesto Fiorentino (Italy) in the period February 16-18, 2009. Funds received : 11,475 Euros, I have been the responsible of the project.

2008 Lorentz Center funds to support a Workshop in Leiden

The Lorentz Center in Leiden (The Netherlands) on the basis of a project submitted by myself together with M. Cencini (ISC, Rome), F. Battaglia (UvA, Amsterdam), and N. Brunel (University Rene Descartes, Paris), has appropriated funds for 22,700 Euros to organize a two weeks workshop in Leiden on "Network Synchronization: from dynamical systems to neuroscience". The workshop lasted from 18th to 30th May 2008 with 38 participants and 20 invited speakers.

2005-2007 Marie Curie Individual Intra-European Fellowship – No 011434 - DEAN

Individual Fellowship within the European HRM Activity denominated "DEAN - Dynamical Entropies in Assemblies of Neurons" awarded to Dr. Thomas Kreuz (Germany). The total amount of the grant was 136,942 Euros and its duration 24 months. The scientific responsible was officially Dr. A. Politi, but due to his absence from Italy, I acted "de facto" as scientific and management responsible of the project.

2005-2008 STREP European Project – No 12835 - EMBIO

STREP project within the European "New and Emerging Science and Technology" Programme denominated "EMBIO - Emergent organisation in complex biomolecular systems" coordinated by Prof. R. Glen (University of Cambridge - UK), involving research groups from Firenze (Italy), Groeningen (The Netherlands), Goteborg (Sweden), Vienna (Austria), Leipzig, Jena and Heidelberg (Germany). The duration of the project was 42 months and the total amount of the grant 2 milions of Euro. The local project responsible was Dr. Lapo Casetti (University of Firenze), and I have been the responsible within CNR, I received 50,000 Euros to cover the costs for a PhD position for three years.

2005 Support for an International Workshop from the Max-Planck Gesellschaft

The Max-Planck-Institut fuer Physik Komplexer Systeme of Dresden (Germany) has supported with 7,000

Euros the international workshop "Towards the Future of Complex Dynamics: From Laser to Brain", held from May 30th until June 1st, 2005 in Dresden. I have been co-organizer of the workshop with M. Baer (PTB, Berlin) e H. Kantz (MPIPKS, Dresden).

2003 Support for an International Workshop from the Max-Planck Gesellschaft

The Max-Planck-Institut fuer Physik Komplexer Systeme of Dresden (Germany) has supported with 21,000 Euros the international workshop "Trends in Pattern Formation: From Amplitude Equations to Applications" held from August 24th until September 19th, 2003 in Dresden with more than 70 participants. I have been co-organizer of the workshop with M. Baer (PTB, Berlin), H. Engel, E. Schöll (TUB, Berlin).

3.2 Other scientific achievements

3.2.1 Active participation in national and international conferences in the last years

3.2.1a Organization of national and international conferences, outreaching activity

I have co-organized 14 international workshops on subjects ranging from pattern formation to protein folding, from out-equilibrium phase transitions to information propagation in extended systems, from neuroscience to mechanical manipulation of biomolecules. For a complete list see here

http://www.fi.isc.cnr.it/users/alessandro.torcini/conferences.htm

I have also coordinated a series of talks in Statistical Mechanics and Nonlinear Dynamical Systems in Firenze in the period 1997-2002 and more recently a Journal Club in Neuroscience (2007-).

In the last ten years I have been co-organizer of the following workshops:

March 17th-20th, 2014 - NETT Workshop "Dynamics of neural circuits" in collaboration with T. Kreuz and S. Schultz, CNR, Sesto Fiorentino (Italy)

July 18th, 2013 - CNS13 Workshop: "Relevance of Synaptic Plasticity for Multistable Behaviour in Neural Systems" in collaboration with C. Hauptmann, Paris (France)

June 24-29, 2013 - Member of the Scientific Commitee of the Workshop: "XVIII CONVEGNO NAZIONALE DI FISICA STATISTICA E DEI SISTEMI COMPLESSI" University of Parma, Parma (italy)

June 04th, 2013 - DD2013 Minisymposium : "Collective Behavior in Networks of Oscillators " in collaboration with R. Töjnes, Madrid (Spain)

July 28th, 2011 - CNS11 Workshop: "Relevance of coherent neural activity for brain functionality" in collaboration with M. Rosenblum, Stockholm (Sweden)

July 5-9, 2010 - Member of the Scientific Commitee of the Workshop: "Nonlinear Dynamics on Networks" in collaboration with P.Ashwin, A. Dmtriev, M. Hasler, Y. Maistrenko, A. Pikovsky, M. Wolfrum, Kyiv (Ucraina)

September 7-9, 2009 - INFN Workshop: "Biophys09 - Biology and Beyond", Arcidosso (Grosseto, Italy). Organization of the workshop in collaboration with F. Bagnoli, A. Bazzani, M. Caselle, P. Freguglia, S. Morante.

February 16-18, 2009 - ESF Workshop: "BioStruct09 - Unraveling the structure of biomolecules: from nonequilibrium statistical mechanics to mechanical manipulation", Area CNR Sesto Fiorentino (Italy). Organization of the workshop in collaboration with A. Imparato.

May 19-30, 2007 - International workshop "Network synchronization: from dynamical systems to neuroscience", Lorentz Center - Leiden (Olanda). Organization of the workshop in collaboration with F.P. Battaglia, N. Brunel and M. Cencini,

May 30 - June 01, 2005 - Organization in collaboration with M. Bär and H. Kantz, of the International Workshop "Towards the Future of Complex Dynamics: From Laser to Brain", Max-Planck-Institut für Physik Komplexer Systeme - Dresden (Germany).

August 24 - September 19, 2003 Organization in collaboration with M. Bär, H. Engel, E. Schöll of the International Workshop "Trends in Pattern Formation: From Amplitude Equations to Applications" Max-Planck-Institut für Physik Komplexer Systeme - Dresden (Germany)

February 6-7, 2003 Organization in collaboration with L. Bongini and R. Livi of the International Workshop "Workshop Forum STADYBIS", Plesso Didattico - Firenze (Italy)

3.2.1b Talks given at national and international conferences in the last 10 years

"Clique of functional hubs orchestrates population bursts in developmentally regulated neural networks", Italy-Israeli meeting "Let the complex be simple" , Tel Aviv University, (December, 02nd, 2014)

"Clique of functional hubs orchestrates population bursts in developmentally regulated neural networks", INMED, Marseille (France) (September, 01st, 2014)

"Hysteretic transitions in the Kuramoto model with inertia", International Conference on Control of Self-Organizing Nonlinear Systems, Rostock (Germany) (August, 28th, 2014)

"Linear stability in networks of pulse-coupled neurons", 10th AIMS Conference on Dynamical Systems, Differential Equations and Applications , Madrid (Spain) (July, 8th, 2014)

"Sisyphus effect in neural networks with spike timing dependent plasticity", NETT workshop "Dynamics of neural circuits", CNR, Sesto Fiorentino (Italy) (March, 17th, 2014)

"Sisyphus Effect in Plastic Neural Networks", Von Humboldt Universität, Physics Department, Berlin (Germany) (October, 31st, 2013)

"Sisyphus Effect in Plastic Neural Networks" , Berlin Center for Studies of Complex Chemical Systems, Seminar in Complex Nonlinear Processes in Chemistry and Biology, Berlin (Germany) (October, 25th, 2013) Invited Speaker

"The Sisyphus Effect in neural networks with spike timing dependent plasticity", "From Dynamics to Statistical Physics and Back" MIPKS, Dresden (Germany) (October, 22nd, 2013) Invited Speaker

"The Sisyphus Effect in neural networks with spike timing dependent plasticity", 26th Marian Smoluchowski Symposium on Statistical Physics "Complexity of Brain - Critical Behavior" , Krakow (Poland) (August, 28th, 2013) Plenary Speaker

"Sisyphus effect in neural networks with plasticity ", CNS13 Workshop, Paris (France) (July 18, 2013) Invited Speaker

"Sisyphus effect in neural networks with spike timing dependent plasticity ", NETT Summer School 2013, University Park , University of Nottingham (July 03, 2013) Plenary Speaker

"Sisyphus effect in neural networks with spike timing dependent plasticity ", Dynamics Days Europe 2013, Center for Biomedical Technology, Madrid (Spain) (June 06, 2013)

"Extensive chaos and collective dynamics in sparse networks", Center for Biomedical Technology, Madrid (Spain) (February 26, 2013)

"Extensive chaos and collective motion in complex (neural) networks: when topology matters", Nottingham University , Nottingham, UK (October 16, 2012)

"Extensive chaos and collective motion in complex (neural) networks: when topology matters", Physikalisch-Technische Bundesanstalt Institut , Berlin, Germany (September, 05 2012)

"Coherent Response of the Hodgkin-Huxley model in the high-input regime", 60 Years of the Hodgkin-Huxley Model , Trinity College, Cambridge, UK (July 13, 2012) Invited Speaker

"Stability of the splay state in networks of pulse-coupled neurons" Neurodynamics: a workshop on heterogeneity, noise, delays, and plasticity in neural systems , Edinburgh (UK) (March 06, 2012) Plenary Speaker

"Collective chaos in pulse coupled oscillators", XXXI Dynamics Days Europe , Oldenburg (Germany) (September, 12, 2011) Invited Speaker

"Unfolding times for proteins in a force clamp", Noise in Life 2010, Benasque (Spain) (October 26, 2010) Plenary speaker

"Collective oscillations in disordered neural networks", International workshop "Nonlinear Dynamics on networks", Kyiv (Ukraine) (July 8, 2010) Member of the scientific committee and plenary speaker

"Nascita di soluzioni collettive in reti neurali", Italian workshop on "XV Convegno Nazionale di Fisica Statistica e dei Sistemi Complessi", Parma (Italy) (June 22, 2010) Plenary speaker.

"Chaotic synchronization of spatially extended systems wuth power-law interactions: an analogy to Levy flight spreading of epidemics" - SIAM conference on "Applications of Dynamical Systems" - Snowbird, Utah (USA) (May 17, 2009) Invited speaker

"Stability criteria for splay states in a network of globally coupled generalized neurons", International Workshop on "Complex Dynamics in Large Coupled Systems" - WIAS, Berlin (Germany) (November 10, 2008) Plenary Speaker.

"Free energy landscape reconstructions for mechanically unfolded proteins", Italian worksop "Biophys08 : Biology and Beyond" - Arcidosso (Gr) (September 11, 2008) Plenary Speaker

"Free energy landscape reconstruction of a pulled protein: Jarzinsky equality versus inherent structures' formalism", Italian workshop entitled "BioINF 2008", Dip. Matematica Applicata, Pisa (June 16, 2008) Plenary speaker.

"Stability of the splay state in pulse-coupled networks", Seminar SFB555: Complex Nonlinear Processes in Chemistry and Biology, Fritz-Haber Institut - Berlin (Germany) (April 18, 2008) Special invitation speaker

"Chaotic synchronization in spatially extended systems ", Oberseminar Nonlinear Dynamics, Freie Universitaet - Berlin (Germany) (April 22, 2008) Special invitation speaker

"Double coherence resonance in neuronal models driven by correlated noise", International workshop "Noise in Life 2007: Stochastic Dynamics in the Neurosciences", Max Planck Institut fuer Physik komplexer Systeme - Dresden (Germany) (November 07, 2007) Plenary speaker

"Synchronization in spatially extended systems", International workshop on "Chaos, Complexity and Transport: Theory and Applications" – Le Pharo - Marseille (France) (June 05, 2007) Plenary speaker

"Coherence effects in the response of neuronal models induced by correlations", International Workshop "SPIE - Fluctuation and Noise" - La Pietra Conference Centre, Firenze (Italy) (May 23, 2007) Invited speaker

"Double coherence resonance in single-neuron models", International workshop on "Brain functions: from basic research to clinical application" - Weizmann Institute, Rehovot (Israel) (March 13, 2007) Plenary speaker

"Synchronization of extended chaotic systems", Journees de Dynamique Non Lineaire - CPT - Luminy, Marseille (France) (November 28, 2006) Special invitation speaker

"Effetti di coerenza nella risposta di modelli di neurone", national workshop entitled "Biophys06 : Back to the Nature", Arcidosso (Gr) (September 07, 2006) Plenary speaker

"Response of single neuronal models to uncorrelated and correlated stochastic inputs", 6th Crimean School and Workshops – Nonlinear Dynamics, Chaos, and Applications Yalta, Crimea, Ukraine (May 15-26, 2006) Plenary Speaker

"Low frequency fluctuations in vertical cavity lasers: experiments versus simulations", International workshop on "Fluctuations and Noise in Out of Equilibrium Systems" - Beaulieu sur Mer (France) (September 14, 2005) Plenary speaker

"LFFs in Vertical Cavity Lasers" Technischen Universitaet Berlin - Berlin (Germany) (May 26, 2005)

"The synchronization transition in spatially extended systems" - "Complex Nonlinear Processes" - Berlin (Germany) (September 11, 2003) Plenary Speaker

"The synchronization transition in spatially extended systems" - "Trends in Pattern Formation: From Amplitude Equations to Applications" - Dresden (Germany) (September 10, 2003) Invited speaker

3.2.2 National and international awards:

1994-1996 Awarded by the European Community of a 2 years Marie-Curie Post-Doc Fellowship in Physics within Human Capital & Mobility Programme (Individual Fellowship) to be spent at University of Wuppertal (Germany)

1997-1998 MURST Post-Doc Fellowship, Ministry for the University and the Research, Italy

1998-2000 INFM Post-Doc Fellowship, National Institute of Condensed Matter Physics, Italy

2006 CNR Short-term mobility fellowship to visit Institute for Nonlinear Science, University of California, San Diego (USA)

2008 Appointed Outstanding Referee by the American Physical Society
Selected together with other 534 scientists (only 6 within Italy) over 42,000 international referees

2011 Awarded by the VELUX Foundation of a 2 months visiting professorship to be spent at Aarhus University, Denmark

2013-2015 Appointed Member of the Editorial Board of Physical Review E, American Physical Society

3.2.3 Editorial assignment in international periodicals :

Member of the Editorial Board of Physical Review E (2013-2015)

Invited editor of the following volumes:

- "Trends in Pattern Formation: Stability, Control and Fluctuations" in collaboration with M. Bär, E. Schöll, and H. Engel, Physica D, volume 199 (2004).
- "The complex Ginzburg-Landau equation: theoretical analysis and experimental applications in the dynamics of extended systems", in collaboration with M. Bär Physica D, volume 174 (2003).
- "Protein Folding: Simple Models and Experiments", in collaboration with L. Casetti, R. Livi et P. Bruscolini, J. Biological Physics, volume 27 (2001).

3.2.4 Review/referee assignment by international periodicals :

I am referee for the following scientific journals:

European Physics Letters, The European Physics Journal B, Physical Review B, Physical Review E, Physical Review Letters, Physica A, Physica D, Journal of Optics A: Pure and Applied Optics, Il Nuovo Cimento,

Physica Scripta, Journal of Statistical Physics, Journal of Statistical Mechanics: Theory and Experiment, Chaos, Journal of Physics A: Mathematical and General, Int. J. Bif. and Chaos, Fluctuation and Noise Letters, , Communications in Nonlinear Science and Numerical Simulations, Chaos, Solitons & Fractals, IEEE Transactions on Neural Networks and Learning Systems, Journal of Neural Engineering, Neurocomputing, PLoS Computational Biology , Hippocampus, PROTEINS: Structure, Function and Bioinformatics.

3.3.5 Assignment as public examiner/opponent :

Since 2004, I have been public examiner in 11 CNR committees for the assignment of fixed-term contracts.

3.5.6 Assignment as outside expert :

February 2013 External member of the commission for the Phd Title of R.G. Diez
Universidad Politécnica de Madrid, Madrid, Spain
Title of the Dissertation:"Collective organization of complex networks"
Supervisor: prof. Stefano Boccaletti

June 2009 External examiner for the postdoctoral position ref N. 212/5-276
Physics and Astronomy Department of Aarhus University (Denmark)
Mentor: prof. Alberto Imparato

2008 External Referee for the PhD dissertation of SI Fewo
Dept. of Physics - University of Yaounde I, Cameroon
Title of the Thesis:"Ultrashort optical solitons
in doped nonlinear optical fibers"
Supervisor: prof. TC Kofane

Dec. 2006 External member of the commission for the Phd Title of C.J. Tessone
Institut Mediterrani d'Estudis Avancats – Universitat de les Illes Balears, Spain
Title of the Dissertation:"Synchronisation and Collective effects in Extended Stochastic Systems"
Supervisor: prof. Raul Toral

2003 External Referee for the MSc Thesis of Simon Cross
Dept. of Mathematics and Applied Mathematics - University of Cape Town (Sud Africa)
Title of the Thesis:"Localised Solutions of the Parametrically Driven
Ginzburg-Landau and Nonlinear Schroedinger Equation"
Supervisor: prof. Igor V. Barashenkov

4. Pedagogical Achievements

4.1 Own teaching effort at undergraduate and postgraduate level :

My pedagogical experience can appear as quite peculiar, however in Italy this was (unfortunately) quite common for people willing to follow the academic career. In 1991, during my PhD, after a national selection, I obtained, at the same time, a national qualification to teach Physics in italian High Schools and a permanent position in the italian High School system. However, I taught at High School only during two periods of my life (namely, 1993/94 and 2001/2003) before getting a permanent position as researcher in 2004 at CNR. All the rest of the time I have been in leave of absence from my teaching position in order to make research activity in Italy and abroad supported by fixed term contracts, fellowships, etc.

During 1993/94 I taught Physics to 14/16 years old pupils, in particular I had to follow 7 classes composed of 28-30 students and I was giving frontal lectures in class as well as practical lectures in a laboratory (18 hours per week). I repeated this experience in 2001/2003 but with only 2 classes for 8 hours per week since this time my position has been part-time. The subjects of the lectures have essentially been Mechanics and Thermodynamics.

At an undergraduate level I have delivered a few courses on Physics and Nonlinear Dynamics at the Faculty of Engineering of the University of Firenze in the period 96-07. From 2011 I teach regularly the undergraduate course "Theory of dynamical systems" at the Physics and Astronomy Department of the Florence University.

Furthermore, during 1999-2013 I have delivered several lectures on biophysical models, computational neuroscience and synchronization phenomena at the PhD course of *Physics and Astronomy* as well as at the PhD course on *Nonlynear Dynamics and Complex Systems* of the University of Firenze.

I have also delivered courses on chaos, synchronization and collective dynamics at the Department of Physics and Astronomy of the Aarhus University (Denmark) and at the Complex Systems Institute Paris Ile-de-France (ISC-PIF), France. Since 2012 I am the coordinator for CNR of an european Marie Curie Initial Training Network on Neural Engineering Transformative Technologies, this training initiative is devoted to the creation of new professional figures at the border between applied mathematics, neuroscience, ingeneering and physics. So far we have recruited 17 PhD students and we are tutoring them for the next 3 years.

My supervisor activity for MSc and PhD thesis has been normally done in an unofficial way, therefore I followed unoficially something like 10 PhD students in the period 1996-2011 and officially only 4 Msc and 3 PhD students, on subjects ranging from spatially extended systems to protein folding, from statistical mechanics of out-of-equilibrium systems to computational neuroscience.

Finally, I would like to mention as a quite intense and useful pedagogical experience the 20 months period of my civil service (1987/89) spent following a class of 15 teenagers with severe physical and/or psychological difficulties.

4.1a Teaching interests

My research position at CNR does not imply any teaching duty, therefore all the courses I have delivered are made on a volunteer basis without receiving any income. I think this clarifies quite well that I really like to teach, and I like the interaction with students. I usally care of my students, and I make any effort to give clear lectures and to verify that some transmission of knowledge occurs between me and the students.

I am interested and available to deliver courses at the undergraduate level on Dynamics, Thermodynamics, Physics of Liquids and Fluids, and at a graduate level on Nonlinear Dynamics, Complex Systems, Computational Neuroscience, Numerical Algorithsm, Statistical Mechanics. Furthermore, I am interested in tutoring undergraduate and graduate students and to supervise their BSc, MSc, and PhD thesis. Due to my past experience, I think I can fruitfully interact with students coming from different areas, namely, Biology, Chemistry, Physics, Engineering.

4.1.b List of delivered courses

Undergraduate Course : "Theory of Dynamical Systems" (April 2014- June 2014)
Laurea Magistrale in Scienze Fisiche e Astrofisiche
Physics and Astronomy Dept. - University of Firenze (26 hours)

Undergraduate Course : "Theory of Dynamical Systems" (April 2013- June 2013)
Laurea Magistrale in Scienze Fisiche e Astrofisiche
Physics and Astronomy Dept. - University of Firenze (24 hours)

PhD Course on Synchronization and Collective Phenomena (April/May 2012)
XXVII Cycle - PhD on Physics and Astronomy
University of Firenze - Faculty of Science
XXVII Cycle - PhD on "Dinamica Nonlineare e Sistemi Complessi"
University of Firenze - Faculty of Engineering (12 hours)

Undergraduate Course : "Theory of Dynamical Systems" (Dec. 2011- Jan. 2012)
Laurea Magistrale in Scienze Fisiche e Astrofisiche

Physics and Astronomy Dept. - University of Firenze (24 hours)

Undergraduate Course: "From Chaos to Synchronization" (Oct/Dec 2011)
Department of Physics and Astronomy of the Aarhus University (Denmark) (14 hours)

PhD Course on Synchronization and Collective Phenomena (April/May 2011)
XXVI Cycle - PhD on Physics and Astronomy
University of Firenze - Faculty of Science
XXVI Cycle - PhD on "Dinamica Nonlineare e Sistemi Complessi"
University of Firenze - Faculty of Engineering (12 hours)

International Course: "Collective Dynamics in -Not Too- Complex Networks" (August 2010)
4th Annual French – Complex Systems Summer School held at ISC-PIF in Paris (France)
30 students of different nationalities - 8 hours of course in 5 lectures

PhD Course on Neuronal Coding (June 2009)
XXIV Cycle - PhD on "Dinamica Nonlineare e Sistemi Complessi"
University of Firenze - Faculty of Engineering

PhD Course on Neuronal Models and Neuronal Coding (July 2008)
XXIII Cycle - PhD on "Dinamica Nonlineare e Sistemi Complessi"
University of Firenze - Faculty of Engineering

Undergraduate Course : "Physics of the Dynamical Systems" (Oct-Dec, 2007)
Laurea Specialistica in Ingegneria dell'Automazione
University of Firenze - Faculty of Engineering

PhD course on Neuronal Models (May 2007)
XXII Cycle - PhD on "Dinamica Nonlineare e Sistemi Complessi"
University of Firenze - Faculty of Engineering

Coordinator and teacher for the PhD lectures on:
"Simple models of biological interest: from proteins to neurons" (april-may, 2006)
XXI Cycle - PhD on "Dinamica Nonlineare e Sistemi Complessi"
University of Firenze - Faculty of Engineering

Undergraduate Course on "Integration Schemes for Ordinary Differential Equations" (Jan 2002)
University of Aix-Marseille III (St. Jerome)
4th year students of the DESS course "Formation chimique"

Phd Course on "Protein Folding as an Activation Process" (July, 2001)
XVI Cycle – PhD on "Dinamica Nonlineare e Sistemi Complessi"
University of Firenze - Faculty of Engineering

Tutorial Activity for Students and Seminar Organization (1997/98)
Energetic Department University of Firenze
Undergraduate Course on "Dynamical Systems"
Responsible of the course: Prof. Stefano Ruffo

Teaching Assistant in Physics (1996)
Diploma di Ingegneria Ambientale e Risorse - University of Firenze
Title of the Course : "Physics I"
Responsible of the course: Prof. Stefano Ruffo

I have also been Physics teacher at the high school for some period:

Physics Teacher for students of Secondary School
50 pupils (2 classes) : 8 hours a week for 2 years
Istituto Tecnico Industriale "T. Buzzi" - Prato (Italy) (2001-2003)
Employer: Italian Ministry for Public Education

Physics Teacher for students of Secondary School
210 pupils (7 classes) during 9 months : 18 hours a week
Istituto Tecnico per Geometri "A.Gramsci" - Prato (Italy) (1993-1994)
Employer: Italian Ministry for Public Education

4.2 Academic supervising experience :

4.2.1 Degree Project Works :

Supervisor for the "Tesina di Laurea" (as part of the MSc thesis) of Vasco Abiuso : "Front Propagation in Reaction-Diffusion Systems" Academic course in Physics at the University "La Sapienza" of Roma (A.A. 2000/01) - May 24, 2001

4.2.2 Licentiate and/or doctoral students :

In Italy the Laurea (MSc) thesis is realized by performing research activity and it can take a period from 1 year to 1 year and half. Moreover, it implies the writing of a dissertation of roughly 100 pages, the supervising activity is therefore not negligible.

2010-2012 Supervisor for the PhD thesis of Simona Olmi
PhD course on "Dinamica Nonlineare e Sistemi Complessi" – University of Firenze
Title of the dissertation: "Collective dynamics in complex neural networks"

2009-2010 Supervisor for the Laurea (BSc) thesis of Iacopo Di Pietro
Academic course in Physics at the University of Firenze (A.A. 2009/10)
Title of the thesis : "Collective solutions in neural networks"

2008-2009 Co-supervisor in collaboration with Prof. R. Livi
for the "Laurea Specialistica" (MSc) thesis of Simona Olmi
Academic course in Theoretical Physics University of Firenze
Title of the thesis : "Dynamics of pulse coupled diluted neural networks"
Final mark: 110/110 cum Laude

2006-2008 Supervisor for the PhD thesis of Stefano Luccioli
PhD course on "Dinamica Nonlineare e Sistemi Complessi" – University of Firenze
Title of the dissertation: "Reconstruction of the free energy landscape of proteins via mechanical manipulation"

2004-2005 Supervisor for the the "Laurea" (MSc) thesis of Stefano Luccioli
Academic course in Physics University of Firenze
Title of the thesis : "Dinamics of realistic single neuron models"
Final mark: 110/110

1999-2000 Supervisor for the "Laurea" (MSc) thesis of Annalisa Tiberio
Academic course in Physics University of Firenze
Title of the thesis : "Dynamics and activation processes in models of etheropolymers"
Final mark: 103/110

1997-1998 Co-supervisor in collaboration with Profs. R. Genesio and S. Ruffo
for the "Laurea" (MSc) thesis of Massimo Nitti

Academic course in Electronic Engineering University of Firenze
Title of the thesis : Methods for the analysis of nonlinear dynamical behaviours in excitable media
Final mark: 110/110 cum Laude

4.2.3 Doctoral student at present being supervised :

2013-2015 Supervisor for the PhD thesis of David Angulo Garcia (Marie-Curie PhD - project NETT)
PhD course on "Dinamica Nonlineare e Sistemi Complessi" – University of Firenze
Project: "Emergence of collective dynamics in scale-free neural networks"

2013-2015 Co-supervisor for the PhD thesis of Nebojsa Bozanic (Marie Curie PhD - project NETT)
PhD course on "Dinamica Nonlineare e Sistemi Complessi" – University of Firenze
Project: "Measures of spike train synchrony"

2011-2014 Co-Supervisor for the PhD thesis of Kaare Mikkelsen
PhD course on Astronomy and Physics – University of Aarhus (Denmark)
Project: "Neural dynamics with spike-timing dependent plasticity"

4.2.4 Mentor of the following post-docs for the specified periods :

2013 - Dr. Simona Olmi - Post-doc within the CRISIS LAB project - ISC-CNR, Sesto Fiorentino

2012 - 2013 Dr. Mario Dipoppa - Post-doc at University College of London

2011 - 2012 Dr. Massimo Calamai - Post-doc at INFN, Pisa (Italy)

2009 - Dr. Stefano Luccioli - Post-doc within the Joint Italian-Israeli Neuroscience Laboratory, ISC-CNR

2005 - 2010 Dr. Thomas Kreuz - Senior Researcher at ISC-CNR

5. Administrative assignments

5.1 Management and Coordination Activity:

Jan. 1st 2013 — Coordinator of the italian research group partecipating to the Joint Italian-Israeli Laboratory on Neuroscience located at Tel Aviv University (Israel) and at Istituto dei Sistemi Complessi ISC-CNR (Italy) and supported by the Italian Foreign Ministry.

Jan. 1st, 2012 — Coordinator of the research group "Dynamical Behaviour of Complex Systems" composed by 10 senior researchers, 2 researchers, 4 Post-Docs, 4 PhD and 2 Master students within Istituto dei Sistemi Complessi - CNR in Sesto Fiorentino

I am member of the Steering Committees of
- the Italian Society for Chaos and Complexity (SICC) (since 2014)
- the Complex Dynamics Inter-Departmental Center of the University of Firenze (since 2007),
- the PhD course in Complex Dynamics of the University of Firenze (since 2009)

5.2 Membership of boards distributing research funds:

I have been member during 2000-2001 of the regional committee distributing european funds to didactic projects in Physics within Tuscany (Italy)

In the last 5 years I have been referee for the following national funding agencies :

- The Netherlands Organization for Scientific Research (NWO) - The Netherlands;
- L'Agence Nationale de la Recherche (ANR) - France;
- The National Fund for Scientific & Technological Development (FONDECYT) - Chile.
- Czech Science Foundationn - Czech Republic

6. Research Synopsis

6.1 Past Research Activity

My research activity has been related to research fields ranging from Theory and Simulation of Liquids to Nonlinear Dynamics of Complex Systems, from Out-of-equilibrium Statistical Mechanics to Biological Physics. My Laurea (MSc) Thesis (1989/90) under the supervision of Prof. A. Politi has been devoted to the investigation (mainly numerical) of spatially extended chaotic systems and to the characterization of these high dimensional diffusively coupled systems (namely, coupled map lattices) in terms of chaotic indicators, like fractal dimensions and Lyapunov spectra [1-3,5]. The most relevant results concerns the analytical estimation of Lyapunov spectra for coupled Bernoulli maps [1], the evidence found of the practical impossibility to employ fractal dimensions to distinguish noise from spatio-temporal chaos [2], the pioneeristic application of the ζ-formalism to characterize spatio-temporal chaos in terms of unstable periodic orbits [3,5]. During my PhD Thesis (1991/93) under the supervision of Dr. U. Balucani I have studied the dynamics of simple and molecular liquids via numerical techniques of molecular dynamics as well as theoretical approaches (mode-coupling theories) [4,6-10,12-14,17-19]. The main achievements concern the discover of a corresponding states law for the structural and dynamical properties of all the liquid alkali metals in proximity of their melting point [4,6] (a result confirmed also by neutron scattering and X-ray experimental data) and the theoretical interpretation of the so-called "fast-sound" propagation in liquid water observed in inelastic neutron scattering experiments [7,9]. The results of my PhD thesis are at the basis of several chapters of the book *Dynamics of the Liquid State* by U. Balucani and M. Zoppi, Oxford University Press, 1995.

During 1994-1996, supported by a European Marie-Curie grant, I moved to Wuppertal (Germany) to work on multifractal properties of spatio-temporal chaotic systems with Prof. Dr. Peter Grassberger. This period has been extremely fruitful, since I started my activity on linear and non-linear mechanisms ruling information propagation in spatially extended systems [11,15,25,38,41] by drawing a parallel between information propagation in chaotic systems and linear and non-linear front propagation in reaction-diffusion systems , like the Fisher-Kolmogorov-Petrovsky-Piskunov equation [15]. These results and the relationship with "stable chaos" have been recently summarized in a review article with A. Politi [105]. Moreover, in collaboration with S. Lepri and A. Politi, we have introduced new families of Lyapunov exponents to characterize spatio-temporal chaotic systems [16,22,27,31,86], these approaches are nowadays reported in textbooks (see H.W. Schuster and W. Just, *Deterministic Chaos*, 2005 and M. Cencini, F. Cecconi, A. Vulpiani, *Chaos*, 2009). Always during this period spent I started the study of out-of-equilibrium phase transitions in reaction-diffusion systems (like the complex Ginzburg-Landau equation (CGLE)), in particular I introduced a new order parameter to describe the transition between two chaotic phases [20,24]. The mechanism at the origin of this transition has been explained only few years later in a series of papers I have published in collaboration with researchers of the Max-Planck-Institut fuer Physik komplexer Systeme in Dresden (namely, L. Brusch, M. Baer, and M. van Hecke) [36,39,44,47]. The renowned review article "The world of the complex Ginzburg-Landau equation" by I.S. Aranson and L. Kramer, Rev. Mod. Phys., 2002 has devoted large space to our results. We also employed our theory to explain the emergence of "super-spirals" experimentally observed in Belousov-Zhabotinsky chemical reactions [47].

In 1997 I moved back to Firenze to work with Prof. S. Ruffo and Dr. T. Dauxois on the dynamical properties of Hamiltonian systems, namely on the relaxation times towards equilibrium of chains of anharmonic oscillators (generalization of Fermi-Pasta-Ulam models) [26,29,30]. Of particular relevance has been the discover of localized excitations, similar to "breathers", but chaotic, which rules the energy equipartition in such systems once excited in the highest frequency modes [29]. The paper reporting these results, [29], is my most cited article. More recently we have numerically shown for the fist time that breathers can emerge also in realistic coarse-grained models of proteins [78].

In collaboration with M. Antoni and S. Ruffo, I have also studied the thermodynamical and dynamical properties of many body Hamiltonian systems with long range interactions [28,33,43,50,102,103]. These pioneering

results have been cited in all the relevant review articles concerning Hamiltonian system with long range interactions appeared in the last 10 years. Recently, we have solved in collaboration with H. Chaté, F. Ginelli, T. Kazumasa, and A. Politi, the long-standing problem of the chaoticity of the clustered pahse in these modeld [79.80].

In 1999, I started my collaboration with Prof. R. Livi by considering the dynamics of biophysically inspired mesoscopic models for the folding of proteins in their native configuration [40,49,52,70]. In the last ten years I continued to work along this direction, in particular my most recent activity, in collaboration with S. Luccioli, A. Imparato (Aarhus, Denmark) and A. Irbaeck (Lund, Sweden), concerns the mechanical manipulation of biomolecules and the reconstruction of the corresponding free energy landscape via out-of-equilibrium thermodynamical relationship, like the Jarzynski equality and the Crooks theorem [64,67,69,73,74]. The collaboration with R. Livi, together with F. Ginelli (Aberdeen) and M. Cencini (Rome), led also to the study of the synchronization mechanisms in coupled spatio-temporal chaotic systems. This analysis revealed that only two different out-of-equilibrium universality classes are sufficient to describe the possible synchronization transitions in these systems [37,46,48,51,57,66,72]. These results have been recently summarized in an article for Scholarpedia [106].

I spent also one year (2000/01) at University "La Sapienza" in Rome, where I have actively collaborated with Prof. A. Vulpiani on the propagation of fronts in advection-reaction-diffusion systems [45], our theoretical predictions have been later confirmed by experimental results by Paoletti and Solomon in 2005.

6.2 Present Research Activity

In 2004, once obtained a permanent position at Consiglio Nazionale delle Ricerche, I decided to redirect my interests mainly towards computational neuroscience. As a matter of fact, this activity has been quite fruitful, I have been able to establish a small research group on computational neuroscience at Istituto dei Sistemi Complessi, to obtain a permanent position as Senior Researcher for Dr T. Kreuz (previously post-doc within the group) and to attract European and Italian research funding for more than 1,500,000 euros in the last 7/8 years. In particular, thanks to funding from Italian Ministry of Foreign Affairs, we have opened a Joint Laboratory with the Tel Aviv University to study the dynamical evolution of cultured neural networks in collaboration with Prof. E. Ben-Jacob.

For more details see the web page of the group: http://neuro.fi.isc.cnr.it/ .

My research activity in this field has been so far mainly devoted along two axes:

Response of single neurons to stochastic and irregular stimuli [53,59,61,62,65,76];

In these studies we have characterized the response of single neurons to Poissonian trains of excitatory and inhibitory inputs [53,59], in particular the presence of correlations among the stochastic input spike trains can induce an optimal response of the neuron indicated by a *double coherence resonance*: a maximum coherence in the neuronal response occurring for an optimal combination of noise and correlation [59]. Furthermore, in collaboration with the group of prof Abarbanel in San Diego, California, USA we have experimentally measured and characterized the response of neurons of the enthorinal cortex to regular and irregular stimuli [88]. Finally, we carefully analyzed the dynamical transition displayed by the Hindmarsh-Rose neuron from chaotic bursting to chaotic spiking [65].

Emergence of collective behaviors in pulse coupled neuronal networks [54,60,63,71,75,77,81,82,83,84,85,87-92]

One of the main relevant result is the discovery of *stable chaos* in diluted neural networks as a source of erraticity in these *stable* system [54,105], the analogy/differences of this mechanism with the balanced state mechanism and its relevance for neural dynamics have been discussed in details by several authors in the very last years. Furthermore, I have devoted a series of studies to the role of network topology for the emergence of coherent oscillatory dynamics in pulse coupled networks [75,77,81,83] and to the stability analysis of asynchronous (splay) states [63,71,82,85]. In the past year I started to analyze the role of short-term and spike timing dependent plasticity to promote coherent behaviors in pulse coupled networks [87,88,90]. In this context, the results

reported in [88,90] reveal a new collective mechanism that can induce persistent irregular oscillations between strongly and weakly synchronized states, reminiscent of brain activity during slow-wave sleep. This mechanism is due to a continuous feedback between the synaptic adjustments and the coherence in the neural firing.

Thanks to two financed research projects, I am presently pursuing my research activity in (computational) neuroscience in strict collaboration with neuroscience laboratories along the following two lines:

* *Emergence of coherent dynamical behaviors in brain circuits (2010-2015)*

A relevant part of this project involve the Joint Italian-Israeli Laboratory in Neuroscience in Tel Aviv supported by the Italian Ministry of Foreign Affairs from 2010-2015. In collaboration with prof. E. Ben Jacob and P. Bonifazi (University of Tel Aviv) we are studying the influence of hub neurons on the response of neural networks.

In the context of neuroscience, are often reported observations of oscillations, synchronized dynamics or more in general rhythms, characteristic of some neural circuit (see G. Buzsáki, Rhythms of the Brain, 2006). Fluctuating spontaneous activity has been observed in several areas of the brain (K.D. Harris and A. Thiele, Nat Rev Neurosci, 12, 509 (2011)). In particular, irregular oscillations between more and less synchronized states have been revealed in the hippocampus during slow-wave sleep and this activity has been related to memory consolidation in the neocortex (G. Buzsáki, Neuroscience, 31, 551 (1989)). However the nature of these coherent behaviors, or the origin of these collective motions, is rarely addressed from the point of view of dynamical system theory. My principal aim within this framework is to understand the mechanisms underlying these collective motions.

As a first step the influence of different structural and functional architectures in promoting collective neural oscillations will be examined. In this respect, we are finalizing a research together with Dr Bonifazi and Prof Ben-Jacob which will explain theoretically the experimental results reported in (Bonifazi et al, Science, 2009) concerning the role played by hub neurons in orchestrating the neural dynamics. We have just obtained extremely interesting results in this direction pointing out the relevance of correlations among excitability and structural connectivity for the emergence of functional hubs [91].

As a second step the role played by plasticity for the emergence of coherent dynamics in the network will be investigated. In this context, a recent study performed by myself in collaboration with Dr Mikkelsen and Prof. Imparato [88,90], has revealed that spike-timing dependent plasticity can induce persistent irregular oscillations between strongly and weakly synchronized states, reminiscent of brain activity during slow-wave sleep. Furthermore, in [88] it has been shown that the oscillations are due to a mechanism, the Sisyphus Effect, caused by a continuous feedback between the synaptic adjustments and the coherence in the neural firing. In the next future, I aim at investigating if the Sisyphus Effect can be observed in more realistic neural circuits and if such mechanism can shed some light on the slow-wave sleep phase and on its relevance for memory reconsolidation.

* *Modelization of Brain Computer Interface (BCI) experiments (2012-2017)*

I have recently started this activity thanks to a project financed by the European community, namely FP7-ITN EU Project NETT 2012-2016, which involves Prof. S. Coombes at the School of Mathematical Sciences, and Prof. N. Russel at the Department of Electrical and Electronic Engineering of the Nottingham University (UK), and together with Dr. S. Schultz at the Department of Bioengineering of the Imperial College, London (UK). In particular, we plan to analyze the dynamical and topological modifications of a developing cultured neuronal networks under a closed loop stimulation in presence of rewards.

We plan to stimulate a group of neurons in the network with external periodic signals of various frequencies and to register the induced neuronal activity at the level of single neurons as well as at the level of population activity. By implementing different type of feedback control we can hopefully tune the network response and

obtain pre-defined neuronal activities. Thus exploring how a neuronal network can encode predefined dynamical patterns. Since the network will be analyzed over several consecutive days, and since it is known that in the early stages of the culture neurons establish continuously new synaptic connections, it will be of extreme interest to understand not only how the feedback loop modifies the neuronal dynamical response, but also how the developing synaptic architecture of the network is influenced by the feedback. In particular, if specific neuronal activities are related to the emergence of peculiar topological motifs in the network.

The references appearing in square brackets refer to the publication list reported below

7. List of publications

For a more objective evaluation of my activity I report here the value of my H-index (**25**) and the total number of citations of my articles (**1,752**), the number of my indexed publications is **105**, the source of this information is the ISI Web of Knowledge database 2013 employed on date 17/02/2015. From GoogleScholar my H-index is 29 and the total number of citations 2401.

Papers published in peer reviewed journals and preprints :

1) S. Isola, A. Politi, S. Ruffo, A. Torcini, "Lyapunov spectra of coupled map lattices", *Phys. Lett. A*, **143** (1990) p.365
2) A. Torcini, A. Politi, G.P. Puccioni, G. D'Alessandro, "Fractal dimensions of spatially extended systems", *Physica D*, **53** (1991) p. 85
3) A. Politi and A.Torcini " Towards a Statistical Mechanics of SpatioTemporal Chaos" , *Phys. Rev. Lett.*, **69** (1992) p. 3421
4) U. Balucani, A. Torcini, R. Vallauri, "Microscopic Dynamics in Liquid Alkali Metals", *Phys. Rev. A*, **46** (1992) p. 2159
5) A. Politi and A. Torcini, " Periodic orbits in Coupled Henon Maps : Lyapunov and Multifractal Analysis ", *Chaos*, **2** (1992) p. 293
6) U. Balucani, A. Torcini, R. Vallauri, "Liquid Alkali Metals at Melting Point : Structural and Dynamical Properties" , *Phys. Rev. B*, **47** (1993) p. 3011
7) U. Balucani, G. Ruocco, A. Torcini and R. Vallauri, "The fast sound in liquid water", *Phys. Rev. E*, **47** (1993) p. 1677
8) U. Balucani, A. Torcini, R. Vallauri, "Liquid Alkali Metals : Microscopic Dynamics and Transport Coefficients", *J. Non-Cristalline Solids*, **156-158** (1993) p. 43
9) U. Balucani, G. Ruocco, M. Sampoli, A. Torcini, R. Vallauri, "Evolution from Ordinary to Fast Sound in Water at Room Temperature", *Chem. Phys. Lett.*, **209** (1993) p. 408
10) G. Ruocco, M. Sampoli, A. Torcini, R. Vallauri, "Molecular Dynamics Results for Stretched Water", *J. Chem. Phys.*, **99** (1993) p. 8095.
11) A. Politi and A. Torcini, " Linear and Nonlinear Mechanisms of Information Propagation", *Europhys. Lett.*, **28** (1994) p. 545.
12) U. Balucani, G. Ruocco, M. Sampoli, A. Torcini, R. Vallauri, "Longitudinal Collective Modes in Liquid Water", *Nuovo Cimento*, **16D** (1994) p. 817.
13) U. Balucani, A. Torcini, A. Stangl and Chr. Mörkel, "Single-Particle Dynamics in Simple Liquids", *Physica Scripta*, **T57** (1995) p. 13.
14) A. Torcini, U. Balucani, P.H.K. de Jong and P. Verkerk, "Microscopic Dynamics in Liquid Lithium", *Phys. Rev. E*, **51** (1995) p. 3126.
15) A. Torcini, P. Grassberger and A. Politi, " Error Propagation in Extended Chaotic Systems ", *J. Phys. A : Mathematical and General*, **28** (1995) p. 4533.
16) S. Lepri, A. Politi and A. Torcini,"Chronotopic Lyapunov Analysis: (I) a Detailed Characterization of 1D Systems", *J. Stat. Phys.*, **82** (1996) p. 1429.

17) D. Di Cola, A.Deriu, M.Sampoli and A.Torcini, "Proton Dynamics in Supercooled Water by Molecular Dynamics and Quasi-Elastic Neutron Scattering", *J. Chem. Phys.*, **104** (1996) p. 4223.

18) U. Balucani, A. Torcini, A. Stangl and Chr. Mörkel, "Single-Particle Motion in Liquid Sodium: Thermal Crossover between Two Dynamical Regimes", *J. Non-Cristalline Solids*, **207** (1996) p. 299.

19) A. Stangl,Chr. Mörkel, U. Balucani and A. Torcini, "Single-Particle Motion in a Dense Liquid: A Competition of Mode Coupling Effects", *J. Non-Cristalline Solids*, **207** (1996) p. 402.

20) A. Torcini, "Order parameter for the transition from phase to amplitude turbulence", *Phys. Rev. Lett.*, **77** (1996) 1047.

21) A. Torcini, H. Frauenkron and P. Grassberger,"A Novel Integration Scheme for Partial Differential Equations: an Application to the Complex Ginzburg-Landau Equation", *Physica D*, **103** (1997) p. 605.

22) S. Lepri, A. Politi and A. Torcini,"Chronotopic Lyapunov Analysis: (II) Towards an Unified Approach", *J. Stat. Phys.*, **88** (1997) 31.

23) A. Torcini, R. Livi, A.Politi and S. Ruffo,"Comment on: Universal Scaling Law for the Largest Lyapunov Exponent in Coupled Map Lattices", *Phys. Rev. Lett.*, **78** (1997) 1391.

24) A. Torcini, H. Frauenkron and P. Grassberger,"Studies of Phase Turbulence in the One Dimensional Complex Ginzburg-Landau Equation", *Phys. Rev. E*, **55** (1997) 5073.

25) A. Torcini and S. Lepri,"Disturbance Propagation in Chaotic Extended Systems with Long-Range Coupling", *Phys. Rev. E*, Rapid Communication , **55** (1997) R3805.

26) T. Dauxois, S. Ruffo and A. Torcini,"Modulational Estimate for the Maximal Lyapunov Exponent in Fermi-Pasta-Ulam Chains", *Phys. Rev. E*, Rapid Communication, **56** (1997) R6229.

27) S. Lepri, A. Politi and A. Torcini,"Entropy potential and Lyapunov exponents", *Chaos*, **7** (1997) 701.

28) M. Antoni and A. Torcini,"Anomalous Diffusion as a Signature of a Collapsing Phase in 2-d Self-Gravitating Systems", *Phys. Rev. E*, Rapid Communication, **57** (1998) R6233.

29) T. Cretegny, T. Dauxois, S. Ruffo, and A. Torcini, " Localization and Equipartition of Energy in the β-FPU Chain : Chaotic Breathers", *Physica D*, **121** (1998) 106.

30) T. Dauxois, S. Ruffo and A. Torcini , " Analytical estimation of the maximal Lyapunov exponent in oscillator chains ", *J. de Physique IV*, **8** (1998) Pr6-147.

31) A. Politi, A. Torcini and S.Lepri, " Lyapunov exponents from node-counting arguments", *J. de Physique IV*, **8** (1998) Pr6-263.

32) A. Torcini, Ch. Dellago, and H.A. Posch, "Comment on : Lyapunov Exponent of a Many Body System and Its Transport Coefficients", *Phys. Rev. Lett.*, **83** (1999) 2676.

33) A. Torcini and M. Antoni, "Equilibrium and dynamical properties of two dimensional N-body systems with long-range attractive interactions", *Phys. Rev. E*, **59** (1999) 2746.

34) M. Nitti, A. Torcini, and S. Ruffo, "An integration scheme for reaction-diffusion models", *Int. J. Mod. Phys. C*, **10** (1999) 1039.

35) P. Politi and A. Torcini, "Coarsening in surface growth models without slope selection", *J. Phys. A: Mathematical and General*, Letter to the Editor, **33** (2000) L77.

36) L. Brusch, M.G. Zimmermann, M. van Hecke, M. Bär, and A. Torcini, "Modulated Amplitude Waves and the Transition from Phase to Defect Chaos", *Phys. Rev. Lett.* **85** (2000) 86.

37) L. Baroni, R. Livi, and A. Torcini, "Transition to Stochastic Synchronization in Spatially Extended Systems", *Phys. Rev. E*, **63** (2001) 036226.

38) M. Cencini and A. Torcini, "Linear and nonlinear information flow in spatially extended systems", *Phys. Rev. E*, **63** (2001) 056201.

39) L. Brusch, A.Torcini, M. van Hecke, M.G. Zimmermann, and M. Bär, "One-Dimensional Complex Ginzburg-Landau Equation: Modulated Amplitude Waves and Defect Formation", *Physica D*, **160** (2001) 127-148.

40) A.Torcini, R. Livi, and A. Politi, "A dynamical approach to protein folding", *Journal of Biological Physics*, **27** (2001) 181.

41) A.Torcini, A. Vulpiani, and A. Rocco, "Front Propagation in Chaotic and Noisy Reaction-Diffusion Systems: a Discrete-Time Map Approach", *The European Physical Journal B*, **25** (2002) 333-343.

42) A. Torcini and P. Politi, "Coarsening process in one-dimensional surface growth models", *The European Physical Journal B* **25** (2002) 519-529.

43) M. Antoni, S. Ruffo, and A. Torcini, "First and second order clustering transitions for a system with infinite-range attractive interaction", *Phys. Rev. E*, Rapid Communication, **66** (2002) 025103.

44) L. Brusch, A. Torcini, and M. Bär "Nonlinear Analysis of the Eckhaus Instability: Modulated Amplitude Waves and Phase Chaos with Non-zero Average Phase Gradient", *Physica D*, **174** (2003) 152-167.

45) M. Cencini, A. Torcini, D. Vergni, and A. Vulpiani, "Thin front propagation in steady and unsteady flows", *Physics of Fluids* **15** (2003) 679-688

46) F. Ginelli, R. Livi, A. Politi, and A. Torcini, "On the relationship between directed percolation and the synchronization transition in spatially extended systems", *Phys. Rev E* **67** (2003) 046217.

47) L. Brusch, A. Torcini, and M. Bär, "Doppler Effect of Nonlinear Waves and Superspirals in Oscillatory Media", *Phys. Rev. Lett.* **91** (2003) 108302.

48) F. Ginelli, V. Ahlers, R. Livi, D. Mukamel, A. Pikovsky, A. Politi, A. Torcini, "From multiplicative noise to directed percolation in wetting transitions", *Phys. Rev. E*, Rapid Communication **68** (2003) 065102(R)

49) L. Bongini, R. Livi, A. Politi, and A. Torcini, "Thermally activated processes in polymer dynamics", *Phys. Rev. E* **68** (2003) 061111

50) M. Antoni, S. Ruffo, and A. Torcini, "First-order microcanonical transitions in finite mean-field models", Europhys. Lett. **66** (2004) 645.

51) M. Cencini and A. Torcini, "Nonlinearly driven transverse synchronization in coupled chaotic systems ", Physica D **91** (2005) 191.

52) L. Bongini, R. Livi, A. Politi, and A. Torcini, "Exploring the energy landscape of model proteins: a metric criterion for the determination of dynamical connectivity" , Phys. Rev. E **72** (2005) 051929.

53) S. Luccioli, Th. Kreuz, and A. Torcini, "Dynamical response of the Hodgkin-Huxley model in the high-input regime", Phys. Rev. E **73** (2006) 041902.

54) R. Zillmer, R. Livi, A. Politi, and A. Torcini, "Desynchronization in diluted neural networks", Phys. Rev. E **74** (2006) 036203.

55) P. Politi and A. Torcini, "Asymptotic and effective coarsening exponents in surface growth models", The European Physical Journal B **53** (2006) 401

56) F. Ginelli, H. Hinrichsen, R. Livi, D. Mukamel, and A. Torcini, "Contact processes with long range interactions" , J. Stat. Mech. (2006) P08008

57) C.J. Tessone, M. Cencini, and A. Torcini, "Synchronization of extended chaotic systems with long-range interactions: an analogy to Levy-flight spreading of epidemics", Phys. Rev. Lett. **97** (2006) 224101

58) A. Torcini, S. Barland, G. Giacomelli, and F. Marin, "Low frequency fluctuations in a Vertical Cavity Lasers: experiments versus Lang-Kobayashi dynamics" , Phys. Rev. A **74** (2006) 063801.

59) T. Kreuz, S. Luccioli, and A. Torcini, "Double coherence resonance in neuron models driven by discrete correlated noise", Phys. Rev. Lett. **97** (2006) 238101.

60) R. Zillmer, R. Livi, A. Politi, and A. Torcini, "Desynchronized stable states in diluted neural networks", Neurocomputing **70** (2007) 1960.

61) A. Torcini, S. Luccioli, and T. Kreuz, "Coherent response of the Hodgkin-Huxley neuron in the high-input regime", Neurocomputing **70** (2007) 1943.

62) T. Kreuz, S. Luccioli, and A. Torcini, "Coherence resonance due to correlated noise in neuronal models", Neurocomputing **70** (2007) 1970.

63) R. Zillmer, R. Livi, A. Politi, and A. Torcini, "Stability of the splay state in pulse–coupled networks" , Phys. Rev. E **76** (2007) 046102.

64) A. Imparato, S. Luccioli, and A. Torcini, "Reconstructing the free energy landscape of a mechanically unfolded model protein", Phys. Rev. Lett. **99** (2007) 168101.

65) G. Innocenti, A. Morelli, R. Genesio and A. Torcin, "Dynamical phases of the Hindmarsh-Rose neuronal model: studies of the transition from bursting to spiking chaos", Chaos **17** (2007) 043128.

66) M. Cencini, C.J. Tessone, and A. Torcini, "Chaotic synchronizations of spatially extended systems as non-equilibrium phase transitions", Chaos **18** (2008) 037125.

67) S. Luccioli, A. Imparato, and A. Torcini, "Free energy landscape of mechanically unfolded model proteins: extended Jarzinsky versus inherent structure reconstruction", Phys. Rev. E. **78** (2008) 031907.

68) A. Imparato, S. Luccioli, and A. Torcini, "Erratum: Reconstructing the Free-Energy Landscape of a Mechanically Unfolded Model Protein", Phys. Rev. Lett. **100** 159903(E) (2008).

69) S. Mitternacht, S. Luccioli, A. Torcini, A. Imparato, and A. Irbäck, "Changing the mechanical unfolding pathway of $FnIII_{10}$ by tuning the pulling strength", Biophysical Journal **96**, 429-441 (2009).

70) L. Bongini, L. Casetti, R. Livi, A. Politi, and A. Torcini, "Stochastic dynamics of model proteins on a directed graph", Phys. Rev. E **79** 061925 (2009).

71) M. Calamai, A. Politi, and A. Torcini, "Stability of splay states in globally coupled rotators", Phys. Rev. E **80** 036209 (2009)

72) M. Cencini, F. Ginelli, and A. Torcini, "Synchronization of spatio-temporal chaos as an absorbing phase transition: a study in 2+1 dimensions", J. Stat. Mech. (2009) P12018.

73) A. Imparato, S. Luccioli, and A. Torcini, "Out-of-equilibrium versus dynamical and thermodynamical transitions", Prog. Theor. Phys. Supplement **184** 339 (2010).

74) S. Luccioli, S. Mitternacht, A. Imparato, A. Irbaeck, and A. Torcini, "Unfolding times for proteins in a force clamp", Phys. Rev. E as Rapid Communication **81** 010902 (2010).

75) S. Olmi, R. Livi, A. Politi, and A. Torcini, "Collective oscillations in disordered neural network", Phys. Rev. E **81** 046119 (2010)

76) J. Haas, T. Kreuz, A. Torcini, A. Politi, and HDI Abarbanel, "Rate maintenance and resonance in the entorhinal cortex", European J. Neuroscience **32**, 1930-1939 (2010)

77) S. Olmi, A. Politi, and A. Torcini, "Collective chaos in pulse coupled oscillators", Europhys. Lett. **92** 6007 (2010)

78) S. Luccioli, A. Imparato, S. Lepri, S. Piazza, and A. Torcini, "Discrete Breathers in a Realistic Coarse-Grained Model of Proteins ", Phys. Biol. **8** 046008 (2011)

79) K. A. Takeuchi, H. Chaté, F. Ginelli, A. Politi, and A. Torcini, "Extensive and Sub-Extensive Chaos in Globally-Coupled Dynamical Systems", Phys. Rev. Lett. **107** 124101 (2011)

80) F. Ginelli, K. A. Takeuchi, H. Chaté, A. Politi, and A. Torcini, "Chaos in the Hamiltonian mean field model" Phys. Rev. E **84** 066211 (2011)

81) L. Tattini, S. Olmi, and A. Torcini, "Coherent periodic activity in excitatory Erdös-Reniy neural networks", Chaos **22** 023133 (2012)

82) M. Dipoppa, M. Krupa, A. Torcini, and B. S. Gutkin, "Splay states in finite pulse-coupled networks of excitable neurons", SIAM Journal on Applied Dynamical Systems **11** 864-894 (2012)

83) S. Luccioli, S. Olmi, A.Politi, and A. Torcini, "Collective dynamics in sparse networks", Phys. Rev. Lett. **109** 138103 (2012)

84) M. Bär, E. Schöll, A. Torcini, "Synchronization and complex dynamics of oscillators with delayed pulse-coupling", Angew. Chem. Int. Ed. **51** 9489(2012)

85) S. Olmi, A.Politi, and A. Torcini, "Stability of the splay state in networks of pulse-coupled neurons", J. Mathematical Neuroscience **2** 12 (2012)

86) A.K. Jiotsa, A.Politi, and A. Torcini, "Convective Lyapunov Spectra", J. Phys. A: Math. Theor. **46** (2013) 254013.

87) M. di Volo, R. Livi, S. Luccioli, A.Politi, and A. Torcini, "Synchronous dynamics in the presence of short-term plasticity", Phys. Rev. E **87** 032801 (2013)

88) K. Mikkelsen, A. Imparato, and A. Torcini, "Emergence of slow collective oscillations in neural networks with spike timing dependent plasticity", Phys. Rev. Lett. **110** 208101 (2013)

89) S. Olmi, A.Politi, and A. Torcini, "Linear Stability in networks of pulse-coupled neurons", Frontiers in Computational Neuroscience 8:8 (2014).

90) K. Mikkelsen, A. Imparato, and A. Torcini, "Sisyphus Effect in Pulse Coupled Excitatory Neural Networks with Spike-Timing Dependent Plasticity", Phys. Rev. E **89** 062701 (2014).

91) S. Luccioli, E. Ben-Jacob, A. Barzilai, P. Bonifazi, and A. Torcini, "Clique of functional hubs orchestrates population bursts in developmentally regulated neural networks", PLOS Computational Biology 10(9): e1003823 (2014).

92) D. Angulo-Garcia and A. Torcini, "Stable chaos in fluctuation driven neural circuits", Chaos,solitons and fractals **69** 233-245 (2014)

93) S. Olmi, A. Navas, S. Boccaletti, and A. Torcini, "Hysteretic transitions in the Kuramoto model with inertia", Phys. Rev. E **90** 042905 (2014).

94) D. Schüler, S. Alonso, A. Torcini, and M. Bär, "Spatio-temporal dynamics induced by competing instabilities in two asymmetrically coupled nonlinear evolution equations", Chaos **24** 043142 (2014)

95) D. Angulo-Garcia and A. Torcini, "Stochastic modelization of diluted neural networks displaying collective oscillations", Phys. Rev. E (2015), in press

96) P. Politi and A. Torcini, "Dynamics versus energetics in phase separation", J. Stat. Mech. (2014), submitted

Others publications/Book Chapters :

97) A. Politi, G. D'Alessandro, A. Torcini, "Fractal dimensions in coupled map lattices" in *Measures of Complexity and Chaos*, editors N.B. Abraham et al., Plenum Press (New York, 1989) p.409

98) A. Torcini, "Mappe quali sistemi dinamici", in *Metodi ed Applicazioni di Dinamica Nonlineare e Stocastica*, scientific report for E.N.E.A. (National Agency for Alternative Energy Sources) (1990), ed. M. Pettini

99) A. Torcini, "Caos ad alta dimensionalitá", in *Metodi ed Applicazioni di Dinamica Nonlineare e Stocastica* scientific report for E.N.E.A. (1990), ed. M. Pettini

100) U.Balucani, S.D.Duffy, A.Torcini, R.Vallauri, "Transport Properties in Ordinary and Supercooled Liquids", in *Slow Dynamics in Condensed Matter* , eds. K. Kawasaki et al., American Institute of Physics (New York,1992) p. 126

101) U. Balucani, G. Ruocco, M. Sampoli, A. Torcini, R. Vallauri, "Anomalous Sound Dispersion in Liquid Water", in *Hydrogen Bond Networks*, M.C. Bellisent-Funel and J.C. Dore editors, Kluwer Academic Publisher (Dordrecht, The Netherland, 1993) p 405.

102) G. Ruocco, M. Sampoli, A. Torcini, R. Vallauri, "MD Simulations of Stretched TIP4P-water in the Supercooled Regime", in *Hydrogen Bond Networks*, M.C. Bellisent-Funel and J.C. Dore editors, Kluwer Academic Publisher (Dordrecht, The Netherland, 1993) p. 409.

103) A. Torcini, "Disturbance Propagation in Coupled Map Lattices", in *Chaos: The interplay betweeen stochastic and determistic behaviour*, eds. P.Garbaczewski et al. (Lecture Notes in Physics, Springer Verlag, Berlin,1995) , vol. 457 p.537.

104) L. Baroni, R. Livi, and A. Torcini, "Noise-driven Synchronization in Coupled Map Lattices", published in *Dynamical Systems:from Cristal to Chaos*, eds J-M Gambaudo, P Hubert, P Tisseur, and S Vaienti (World Scientific, Singapore,2000) page 23.

105) R.Genesio, M. Nitti, and A. Torcini, "Analysis and Simulation of Waves in Reaction-Diffusion Systems" , Proceedings of the 37th IEEE Conference on Decision & Control Tampa, Florida USA (December 1998), TA16-3 10:40.

106) M. Antoni, S. Ruffo, and A. Torcini, "Dynamics and statistics of simple models with infinite-range attractive

interaction", in *The Chaotic Universe*, editors V. G. Gurzadyan and R. Ruffini (World Scientific, Singapore, 2000) page 467.

107) T. Dauxois, V. Latora, A. Rapisarda, S. Ruffo, and A. Torcini, "The Hamiltonian Mean Field Model: from Dynamics to Statistical Mechanics and back", published in Dynamics and Thermodynamics of Systems with Long Range Interactions eds: T. Dauxois, S. Ruffo, E. Arimondo, and M. Wilkens (Lecture Notes in Physics, Springer, Berlin, 2002) p. 458.

108) L. Brusch, H.K. Park, M. Bär, and A. Torcini, "Spiral Instabilities in Periodically Forced Extended Oscillatory Media", Proceedings of Equadiff03: International Conference on Differential Equations, edited by F. Dumortier (World Scientific, 2005, Singapore) 777-782.

109) A. Politi, and A. Torcini, "Stable Chaos", in Nonlinear Dynamics and Chaos: Advances and Perspectives Eds. Thiel, M.; Kurths, J.; Romano, M.C.; Moura, A.; Karolyi, G., (Springer Verlag, 2010, Heidelberg)

110) A. Torcini and M. Cencini, Synchronization of extended chaotic systems. Scholarpedia, 8(6):30650 (2013)

111) S. Olmi and A. Torcini, Coherent activity in excitatory pulse-coupled networks. Scholarpedia, 8(10):30928 (2013).

List of References

Reference letters can be asked to the following scientists:

Prof. Antonio Politi
Sixth Century Chair in Physics of Life Sciences
University of Aberdeen
King's College
Meston 332, 2301
Aberdeen AB24 3FX, UK
email: a.politi@abdn.ac.uk
phone: +44 (0)1224 272301

Prof. Dr. Eckehard Schöll
Institut für Theoretische Physik
Technische Universität Berlin
Hardenbergstr. 36
10623 Berlin, Germany
email: schoell@physik.tu-berlin.de
phone: +49-30-314-23500

Prof. Roberto Livi
University of Florence
Physics Department
via Sansone, 1
50019 Sesto fiorentino, Italy
email: roberto.livi@fi.infn.it
Phone +39 055 4572332

Prof. Stephen Coombes
University of Nottingham
Faculty of Science
Room B14 The Mathematical Sciences Building
University Park

Nottingham NG7 2RD, UK
email: stephen.coombes@nottingham.ac.uk
Phone +44 (0)115 8467836

Sesto Fiorentino, February 17th, 2015

Alessandro Torcini