

# Marco Formentin, Curriculum Vitæ

## Contact Information:

*Residence Address:* Via San Romano 145, 44121 Ferrara (Fe), Italy, ☎ +39 348 6431404

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## Education and Academic Positions:

- (July 2011 – present) Postdoc position at the University of Padua (Italy) in the group coordinated by Prof. Amos Maritan (Probability/Statistical Mechanics)
- (Oct 2009 – Aug 2011) Postdoc position at the University of Bochum (Germany) in the group coordinated by Prof. Dr. Christof Külske (Probability)
- (Nov 2009) Ph.D. in Mathematics at the Department of Pure and Applied Mathematics of the University of Padova. Advisors: Prof. Paolo Dai Pra and Prof. Dr. Christof Külske
- (Jan 2005, Jan 2006) Stage, Oracle Database Administrator
- (Dec 2004) University of Padova – Laurea (Degree) in Theoretical Physics. Advisor: Prof. Gianfranco Sartori
- Scientific collaborator in the SFB|TR 12 projects C6 and A7

## Schools and Workshops:

- (Aug 2012) “*Interacting Particle Systems and Related Topics*”, (Villa Finaly, Firenze)
- (Jun 2012) “*Disorder in Probability and Statistical Mechanics*”, (Complesso San Geminiano, Modena, Italy)
- (Dec 2010) ESF Research Conference, Eurandom, “*Combinatorics and Analysis in Spatial Probability*”
- (March 2010) YEP VII 2010 (Young European Probabilists): “*Probability, random trees and algorithms*”
- (Jul 2009) International Summer School in Probability, University of Bologna
- (Fall 2008) Fall School of the Institut Henri Poincaré: “*Random Media, Phase Transition and Information Theory*”
- (Jun 2008) 3rd La Pietra Week in Probability: “*Stochastic Models in Physics*”, (Villa La Pietra,

Florence)

- (Fall 2007) GNAMPA Summer School “*De Ludo Aleae*” on Probability (University “La Sapienza”, Rome)
- (Summer 2007) SMI Cortona Summer Course: “*Probability*”
- (Summer 2007) “*Stochastic Processes: Theory and Applications*”, a conference in honor of the 65th birthday of Wolfgang J. Runggaldier (Accademia Cusanus, Brixen)
- (Summer 2007) Annual Meeting of the PRIN project: “*Percolation, Random Fields and Evolution of Stochastic Interacting Systems*” (University of Bologna)
- (Spring 2007) Spring School: “*Stochastic Models of Complex Processes*” (University of Potsdam)

### Research Visits:

- (March 2012) One-week stay at University of Bochum (Germany), guest of the Statistical Mechanics/Probability group at the invitation of Prof. Dr. Christof Külske
- (July 2008-August 2008) One-month stay at University of Groningen (The Netherlands), guest of the Statistical Mechanics/Probability group at the invitation of Prof. Dr. Christof Külske
- (December 2007-March 2008) Three-month stay at University of Groningen (The Netherlands), guest of the Statistical Mechanics/Probability group at the invitation of Prof. Dr. Christof Külske

**Research Interests and Publications:** My research topics stand in the line between Statistical Mechanics and Probability Theory, aiming to the understanding of interacting stochastic systems on a mathematical level. Such systems are made of a large number of particles (atoms, molecules or even individuals) obeying probabilistic rules of interaction on the microscopic level. Varying the strength of the interaction such systems may show different collective behavior and long range order on the macroscopic scale. In this case we say that the system undergoes a phase transition that loosely speaking can be described as a deep qualitative change in the way the system behaves on a large scale. A well known example is the solid-liquid-gas transition of water when increasing the temperature. Of particular interest are disordered systems (i.e. rules of microscopic interaction may locally randomly change) since often their behavior is not even heuristically clear. Moreover they give rise to interesting conceptual probabilistic issues (see publications from [1] to [7]).

Methods and ideas from Probability Theory and Statistical Mechanics go well beyond the realm of Physics. They are used in Finance, Computer Science and Biology. More recently, I started working on probability models of interactive human activities. Nowadays, a huge quantity of data are available for several activities and structures on different time scales: such as emailing, web browsing, topology and dynamics of social networks, paper correspondence or geographical position, internal structure and growth of cities. Analysis of these data can deepen the understanding of human behavior and be used as a starting point for mathematical modeling. The aim is to highlight and understand remarkable statistical regularities through numerical simulation and theoretical analysis of (new) models. Preprints

[8] and [9] point out universal features of common human written communication: emails, paper mails and sms. There in a theoretical framework is also proposed.

Key words for my research are: Mathematical Statistical Mechanics, Probability on Trees and Graphs, Gibbs Measures, Phase Transitions, Disorder Systems, Markov chains, Glauber and Metropolis dynamics, Coupling and Mixing time for Markov chains, Probabilistic models of Human Activities

Here, it is a list of my publications:

- 9 M. Formentin, A. Lovison, A. Maritan, G. Zanzotto, *Scaling and universality in written human communication*, 2012, preprint
- 8 M. Formentin, A. Lovison, A. Maritan, G. Zanzotto, *How priority shapes email communication patterns*, 2012, preprint
- 7 P. Dai Pra, M. Formentin, I. G. Minelli, *Uniform propagation of chaos and fluctuations theorems for some classes of spin-flip models*, 2011, preprint
- 6 M. Formentin, C. Külske, A. Reichenbachs, *Metastates in mean-field models with random external fields generated by Markov chains*, Journal of Statistical Physics, Vol. 146, Num. 2, 2012, available at <http://arxiv.org/abs/1109.4246>
- 5 S.R. Fleurke, M. Formentin, C. Külske, *Dependent particle deposition on a graph: concentration properties of the height profile*, 2010, Markov Processes and Related Fields, Vol. 17 Number 2, 187–208, 2011., available at <http://arxiv.org/abs/1003.4599>
- 4 M. Formentin, (without review), *Due problemi di meccanica statistica: ricostruzione per catene di Markow su alberi di Galton-Watson e propagazione uniforme del caos e teorema delle fluttuazioni in alcuni modelli di spin*, La matematica nella Societ e nella Cultura: rivista della Unione Matematica Italiana. Serie I, Volume 3, Numero 1, 2010
- 3 M. Formentin, C. Külske, *A symmetric entropy bound on the non-reconstruction regime of Markov chains on Galton-Watson trees*, Elect. Comm. in Prob., Issue 14, 587-596, 2009, also available at <http://arxiv.org/abs/0903.2962>
- 2 M. Formentin, C. Külske, *On the Purity of the free boundary condition Potts measure on random trees*, Stochastic Processes and their Applications 119, Issue 9, 2992-3005, 2009, also available at <http://arxiv.org/abs/0810.0677>
- 1 M. Formentin, *Two problems concerning interacting systems: 1. On the purity of the free boundary condition Potts measure on Galtson-Watson trees 2. Uniform propagation of chaos and fluctuation theorems in some spin-flip models*, Ph.D. Thesis, University of Padova, 2009

### Talks:

- (Aug 2012) Villa Finaly, Firenze 2012, Interacting Particle Systems and Related Topics, poster: “Metastates in mean-field models with Markovian disorder”
- (Sept 2010) Oggebbio 2010, SFB 12 meeting, “Information Flow on Trees: some results on the Reconstruction Problem”
- (Jul 2009) University of Bologna, International Summer School in Probability, “Reconstruction for Markov chains on Galton-Watson Trees”
- (Jun 2009) University of Rome 3, “Reconstruction for Markov chains on Galton-Watson Trees”

- (Jan 2009) University of Verona, Workshop: Stochastic models with many degrees of freedom: Theory and Applications, “*Information Flow on Trees: the Reconstruction Problem and the Purity of the Free Gibbs Measure*”
- (Oct 2008) University of Padova, Seminario Dottorato, “*Information Flow on Trees: the Reconstruction Problem and the Purity of the Free Gibbs Measure*”.
- (Dec 2006 ) University of Groningen, Dynamical Seminars, “*The Geometry of the Spontaneous Symmetry Breaking*”

### Teaching and Working Experiences:

- During my period at the Bochum University, in collaboration with Prof. Külske, I organized two series of talks for students: the first on Markov chains, the second, more advanced, about Probability on Trees and Graphs.  
I also co-supervised the bachelor thesis of
  1. Katharina Günter, *Electrical Networks and Recurrence/Transience of Symmetric Random Walk on Graphs* (in German),
  2. Philipp Schriever, *Gibbs Measures and Phase Transitions on Trees* (in English)
- (Summer Semester 2011) Ruhr-Universität Bochum, Fakultät für Mathematik, Recitations in *Mathematical Statistics I*; teacher: Prof. Dr. Christof Külske
- (Winter Semester 2010) Ruhr-Universität Bochum, Fakultät für Mathematik, Recitations in *Introduction to Probability and Mathematical Statistics*; teacher: Prof. Dr. Christof Külske
- (Summer Semester 2010) Ruhr-Universität Bochum, Fakultät für Mathematik, Part of the lectures of the course *Interacting Stochastic Particle Systems*; main teacher: Prof. Dr. Christof Külske. My part concerned Gibbs Measures and Phase Transitions on trees
- (Summer Semester 2010) Ruhr-Universität Bochum, Fakultät für Mathematik, Recitations in *Algebra II*; teacher: Prof. Dr. Christof Külske
- (Winter Semester 2009) Ruhr-Universität Bochum, Fakultät für Mathematik, Part of the lectures of the course *Interacting Stochastic Particle Systems*; main teacher: Prof. Dr. Christof Külske. My part concerned coupling and mixing time properties of Glauber and Metropolis dynamics for Statistical Mechanics models
- (Winter Semester 2009) Ruhr-Universität Bochum, Fakultät für Mathematik, Recitations in *Introduction to Probability and Mathematical Statistics*; teacher: Prof. Dr. Herold Dehling
- (Oct 2008, Mar 2009) High school Math teacher, Istituto Duca degli Abruzzi, Treviso, Italy
- (Spring Trimester 2007) Department of Pure and Applied Mathematics, University of Padova, Recitations in *Probability and Statistics*; teacher: Prof. Tiziano Vargiolu

- (Spring Trimester 2006) Department of Physics “Galileo Galilei”, University of Padova, Recitations in *Calculus 2*; teacher: Prof. Silvana Bazzoni

### Additional Information:

*Language skills:* Italian (mother tongue), English, French (basic)

*Computer skills:* Fortran programming language, PL/SQL, L<sup>A</sup>T<sub>E</sub>X, Mathematica

### Academic Referees:

- Prof. Dr. Christof Külske,  
Ruhr-Universität Bochum, Fakultät für Mathematik, Universitätsstraße 150, 44780 Bochum, Germany  
✉ [Christof.Kuelske@rub.de](mailto:Christof.Kuelske@rub.de),  
📄 <http://www.ruhr-uni-bochum.de/ffm/Lehrstuehle/Kuelske>
- Prof. Amos Maritan,  
Università degli Studi di Padova, Dipartimento di Fisica e Astronomia “Galileo Galilei”, Via Marzolo 8, 35131, Padova, Italy  
✉ [maritan@pd.infn.it](mailto:maritan@pd.infn.it),  
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- Prof. Paolo Dai Pra,  
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- Prof. Giovanni Zanzotto,  
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