

CURRICULUM VITAE

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Education and research

2013 - *Marie Curie Fellow* at the Institute for Systems Neuroscience (Aix-Marseille University, France). Associated scientist at the Max Planck Institute for Dynamics and Self-organization (Göttingen, Germany).

2009 - 2013 *Postdoc* at the Max Planck Institute for Dynamics and Self-organization (Theo Geisel's group, Göttingen, Germany). *Bernstein Fellow* since 2013.

2006 - 2008 *Postdoc* at the Laboratory of Neurophysics and Physiology, (David Hansel's group, University Paris Descartes, Paris, France).

2002 - 2005 *PhD* in Condensed Matter Theory and Statistical Physics at the International School for Advanced Studies (SISSA, Trieste, Italy), awarded "*cum laude*" (highest honors). Title: "Survey propagation methods for efficient optimization and probing of glassy states" (work at the interface between statistical physics and computer science and information theory). Director: Riccardo Zecchina.

1997 - 2002 *Master* in Theoretical Physics at the University of Turin (Italy), awarded "*con menzione onorevole*" (highest honors). Title: "Quantum mechanics over discrete space-time graphs". Director: Mario Rasetti (Polytechnic school of Turin).

Skills and research topics

Trained initially as a theoretical physicist, I have conducted researches *at the interface between Information science, Neuroscience and Physics of complex systems*, developing notably the following interdisciplinary skills:

Theory of complex systems

Statistical Physics (classical and quantum spin glasses and random networks); graph theory concepts and algorithmic methods; Nonlinear Physics and Chaos Theory; dynamical systems with delay.

Neuroscience: modeling and theory

Methods: large scale simulations of multi-scale networks of spiking neurons; rigorous analysis of mean-field models of interacting neuronal populations (meso- and whole-brain scale); information theory methods.

Applications: modeling of dynamic information routing in modular brain networks; modeling of sparsely synchronized neural oscillations and of dynamical regimes at the edge of synchrony; modeling of cortical circuits with anatomically-inspired multi-layer architecture; data-constrained models of attentional modulation.

Neuroscience: methodology and data analysis

Methods: cluster analysis and inference with fuzzy logic methods; non-linear time-series analysis; linear, nonlinear functional and causal connectivity analysis; Transfer Entropy methods; frequency and time-frequency domain spectral analysis.

Applications: unsupervised classification of neuronal types, characterization of typical and atypical neurons; structural connectivity reconstruction of neuronal cultures from the calcium imaging of their activity; characterization of state-dependent information flow in cell assemblies of entorhinal cortex.

Optimization and coding algorithms

Methods: error-correcting codes, data compression techniques with or without loss of information; local search algorithms for combinatorial optimization; message-passing algorithms for approximate Bayesian inference (Belief and Survey Propagation).

Applications: data-compression and optimization algorithms inspired by classical and quantum spin glass physics; simplified neural-like implementations; implementations on reconfigurable hardware.

Teaching and management

Tutoring and direction of students

Graduate level: tutor and project director for the students *Olav Stetter* (thesis defended 22 October 2012, *magna cum laude*), *Markus Helmer* (starting from January 2011) and *Agostina Palmigiano* (starting from September 2011), at the University of Göttingen (theoretical and computational neuroscience program).

Undergraduate level: direction of the Bachelor student *Anna Christina Eilers* (January-August 2011, University of Göttingen, Physics Faculty; thesis awarded of a *Studienstiftung* scholarship); co-direction of the Master student *Simone d'Amario* (starting from December 2012, director Luca Faes, University of Trento); direction during a training semester of *Xue-Jie Chen* (November 2009-August 2010, now PhD student at Brandeis University).

Teaching

Undegraduate level: over 20 hours of teaching in theoretical and computational neuroscience courses at the University of Göttingen (Bachelor and Master level, period 2009-2013).

Graduate level: teacher of invited courses of “*Advanced methods for neural data analysis*” (April 2010, 2012, 2013 and 2014, SISSA, Trieste).

Workshop and seminar organization

9-12 June 2008: organizer of the international workshop “*New directions of network modelling*” (University Paris Descartes).

2007-2008: organizer of the weekly seminar cycle of the Laboratory of Neurophysics and Physiology (University Paris Descartes, CNRS UMR 8119).

Other responsibilities

Starting from May 2010 : principal investigator and project coordinator at the Bernstein Center for Computational Neuroscience - Göttingen

Starting from August 2011: associate editor of the journal *Neurocomputing*.

18 November 2011: expert member of the PhD thesis committee of Natalia Grion (title: “*Dynamic coupling between whisking, barrel cortex and hippocampus during texture discrimination: a role for slow rhythms*”; director: Matthew Diamond, SISSA, Trieste).

Computer skills

Programming in C, C++, Fortran 90 and Python.

Parallel computing with MPI libraries.

Computing and data-analysis in MATLAB and Mathematica environments.

VHDL design of FPGA reconfigurable hardware.

Language skills

Italian (mother tongue).

French (bilingual).

English (proficiency, level C2).

German (advanced beginner, level B2).