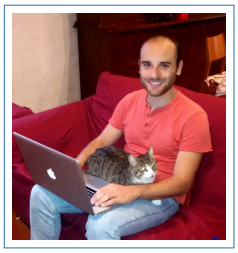

Cosimo Lupo

Curriculum Vitae

Personal info

Place of birth	Francavilla Fontana (BR), Italy
Date of birth	Oct. 30th, 1989
Nationality	Italian
Private Address	Via Fabrizio Luscino, 20 – 00174 Roma (Italy)
Current position	PostDoctoral Researcher at *École Normale Supérieure* of Paris, *Laboratoire de Physique Théorique*

Education

2013 – 2016 **PhD in Physics**, *Sapienza University of Rome*, Rome (Italy).
Thesis defended on Feb. 16th, 2017.

2011 – 2013 **MSc Degree in Physics**, *Sapienza University of Rome*, Rome (Italy).
Thesis defended on Sep. 27th, 2013. Graduation mark 110/110 Cum Laude. Exam average mark 29.83/30.

2008 – 2011 **BSc Degree in Physics**, *Sapienza University of Rome*, Rome (Italy).
Thesis defended on Nov. 8th, 2011. Graduation mark 110/110 Cum Laude. Exam average mark 29.61/30.

2003 – 2008 **High School Degree**, *Scientific High School "F. Ribezzo"*, Francavilla Fontana (BR, Italy).
Graduation mark 100/100 Cum Laude.

Research

Theoretical Physics (SSD FIS/02, SC 02/A2)

Academic career

Feb. 2018 – Present **PostDoc (*Chercheur en CDD*)**, *École Normale Supérieure*, Paris (France).
Belonging to *Laboratoire de Physique Théorique*.

Jun. 2017 – Jan. 2018 **PostDoc (*Assegnista di Ricerca Tip. II*)**, *Sapienza Università di Roma*, Rome (Italy).
Belonging to *Dipartimento di Fisica*.

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Main interest

Statistical mechanics of strongly disordered systems:
- Statics and dynamics of spin glass models with continuous variables
- Random field models and correlation functions
- Energy landscape, inherent structures and localization

Statistical modeling of human immune system:
- B-Cell Receptor (BCR) repertoires: creation, evolution and selection
- Inference and population dynamics of BCRs in both healthy and HIV-affected individuals

Other interests

Structural glasses, random matrices, inference and learning.

Metrics

List of publications attached at the end of the CV. Metrics extracted from databases on 22/03/2019:

	Google Scholar	Scopus	Web Of Science
Number of products	5	2	2
Total citations	11	7	7
Citations per product	2.20	3.50	3.50
Hirsch (H) index	2	1	1

Links to my page on Google Scholar, Scopus, Mendeley and ResearchGate.

Database IDs:
- Orcid: 0000-0002-2651-1277
- Scopus: 57193523109
- ResearcherID: D-1717-2017

Referee of 4 articles for the following Journals: *Entropy*, *Mathematics*. Link to my profile on Publons.

PhD Thesis

Title — *Critical properties of disordered XY model on sparse random graphs*

Supervisor — Prof. Federico Ricci-Tersenghi (also in collaboration with Prof. Giorgio Parisi)

Subject — Statistical mechanics of disordered systems

Thesis defence — Feb. 16th, 2017. External referees: Prof. Florent Krzakala (ENS, Paris, France) and Prof. Juan J. Ruiz-Lorenzo (Universidad de Extremadura, Badajoz, Spain).

Abstract The XY model is studied for different sources of quenched disorder (random couplings, random fields, or both them) as the simplest spin model with continuous variables. The belief propagation algorithm and the cavity method are exploited to solve the model on the sparse topology provided by Bethe lattices. It is found that the discretized version of the XY model, the so-called Q-state clock model, allows a reliable and efficient proxy for the continuous model with an error going to zero exponentially in Q, resulting in a remarkable speedup in numerical simulations. Interesting results regard the low temperature solution of the spin glass XY model, which is by far more unstable toward the replica symmetry broken phase with respect to what happens in discrete models. Also the random field XY model possesses this replica symmetry broken phase, in contrast to the random field Ising model on any topology. Then, instabilities of the spin glass XY model in a field are characterized, finding different critical lines according to the different symmetries of the external field, corresponding to the Gabay - Toulouse and de Almeida - Thouless transitions from the fully connected case. Finally, inherent structures of the energy landscape of the spin glass XY model in a random field are described, via the zero-temperature belief propagation algorithm. The ultimate goal is to find a connection between the localization of soft modes and the replica symmetry breaking on sparse graphs.

MSc Thesis

Title *XY model and clock model on sparse random graphs*

Supervisor Prof. Federico Ricci-Tersenghi

Subject Statistical mechanics of disordered systems

Thesis defence Sep. 27th, 2013. Referee: Dr. Luca Leuzzi.

Abstract The XY model is studied as the simplest spin model with continuous variables, in connection with its discretized version, the so-called Q-state clock model. Being on sparse random graphs, the belief propagation algorithm is used to solve the two models. Physical observables are found to exponentially converge to their $Q \to \infty$ value when Q is increased, both in the case of bimodal couplings and in the case of random phase shifts (*gauge glass*), so providing a remarkable enhancement of performances in numerical simulations of disordered systems with continuous variables.

BSc Thesis

Title *Entanglement and Bell's Inequalities*

Supervisor Prof. Fabio Sciarrino

Subject Quantum optics and foundations of quantum mechanics

Thesis defence Nov. 8th, 2011

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Abstract The EPR paradox about completeness of quantum mechanics is analyzed, together with the several hypotheses about its completion. The Bell's theorem is then presented, finally providing a quantitative method (Bell's inequalities and CHSH inequalities) to test the nonlocality of quantum mechanics and in particular of the phenomenon of "entanglement". Eventually, a review about the experimental tests is presented, with a particular attention to those ones exploiting quantum optics, namely photons.

Honors and Awards

2014 *Laureato eccellente Sapienza* award, assigned by *Fondazione Roma Sapienza* and *NoiSapienza Associazione Alumni* for the excellent results obtained during the academic studies.

2013 *Enrico Persico* award for MSc Physics students assigned by *Accademia Nazionale dei Lincei* for the excellent results obtained during the academic studies.

2013 *Percorso d'eccellenza* for best MSc Physics students at *Sapienza University of Rome*.

2011 *Percorso d'eccellenza* for best BSc Physics students at *Sapienza University of Rome*.

2007 *Menzione d'onore* (mention of honor) assigned by *Unione Matematica Italiana* for the remarkable results during the national qualifying stage of the International Mathematical Olympics.

Fellowships and Grants

2017 *Progetti per Avvio alla Ricerca* grant for junior researchers (€ 3 500) from *Sapienza University of Rome* (Rome). PI of the project.

Jun. 2017 – May 2018 PostDoc fellowship from Dept. of Physics, *Sapienza University of Rome* (Rome).

2015 *Progetti di Ricerca* grant (€ 9 000) from *Sapienza University of Rome* (Rome). Participant to the project (PI: Federico Ricci-Tersenghi).

Nov. 2013 – Oct. 2016 PhD fellowship from Dept. of Physics, *Sapienza University of Rome* (Rome). Ranked 2nd in the admission exam.

2013 PhD fellowships from *SISSA* (Trieste) and *Roma Tre* (Rome). Refused to accept the fellowship from *Sapienza*.

Teaching

2017 – 2018 – Teacher of the *OFA* support course in basic mathematical skills of the Faculty of Mathematical, Physical and Natural Sciences. Management of the corresponding e-learning platform on "Moodle". Coordinator of course tutors (appointed by the Head of the Faculty).
– Teaching assistant to *Laboratorio di Fisica Computazionale I* (Advanced C language, 6 CFU) for BSc Degree in Physics.

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2016 – 2017 – Teacher of the *OFA* support course in basic mathematical skills of the Faculty of Mathematical, Physical and Natural Sciences. Management of the corresponding e-learning platform on "Moodle".
– Support to the project *Lab2Go* for the diffusion of physics teaching in the high schools (especially in their labs).

2015 – 2016 – Teacher of the *OFA* support course in basic mathematical skills of the Faculty of Mathematical, Physical and Natural Sciences.

2014 – 2015 – Teaching assistant to *Laboratorio di Calcolo* (C language, 6 CFU) and *Meccanica* (Classical Mechanics, 12 CFU) for BSc Degree in Physics.
– Teacher of the *OFA* support course in basic mathematical skills of the Faculty of Mathematical, Physical and Natural Sciences.

Schools and Workshops attended

2018 *3rd course on Multiscale Integration in Biological Systems*, Institut Curie, Paris (France), November 7 - 13.

2018 *2nd meeting on Stochasticity and Control in Adaptive Immune Repertoires*, Institut des Systèmes Complexes, Paris (France), October 28 - 31.

2018 Workshop *Paris Biological Physics Community Day*, Centre Culturel Irlandais, Paris (France), October 15.

2018 *2nd annual meeting/discussion forum on Physical concepts and computational models in immunology*, École Normale Supérieure, Paris (France), September 26 - 28.

2018 Workshop *Disordered serendipity: a glassy path to discovery*, Sapienza University of Rome, Rome (Italy), September 19 - 22.

2018 Workshop *Stochastic models of evolving populations: from bacteria to cancer*, ICMS, Edinburgh (Scotland), July 16 - 20.

2018 School *Deep Learning and Statistical Physics*, Beg Rohu (France), June 25 - July 7.

2018 *23rd Claude Itzykson Conference: Statistical Physics of Disordered and Complex Systems*, IPhT-CEA, Saclay (France), June 4 - 6.

2018 Workshop *Beyond Mean Field Theory: Renormalisation Group and Non Perturbative approaches in Disordered and Glassy Systems*, Sapienza University of Rome, Rome (Italy), January 3 - 5.

2017 *FisMat 2017*, ICTP-Sissa, Trieste (Italy), October 1 - 5.

2017 Conference *Thermodynamics and Statistical Mechanics of Small Systems*, Sapienza University of Rome, Rome (Italy), September 18 - 20.

2017 *103rd National Congress of the Italian Physical Society*, University of Trento, Trento (Italy), September 11 - 15.

2017 *22nd National Conference on Statistical Physics and Complex Systems*, University of Parma, Parma (Italy), June 28 - 30.

2016 School *Concepts and Methods of Statistical Physics*, Beg Rohu (France), August 22 - September 3.

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2016 *Renormalization Group Theory of Disordered Systems. A satellite meeting of StatPhys 2016*, École Normale Supérieure, Paris (France), July 25 - 27.

2016 *StatPhys 2016*, Palais Des Congres, Lyon (France), July 18 - 22.

2016 *Statistical Physics Methods in biology and computer sciences. A satellite meeting of StatPhys 2016*, École Normale Supérieure, Paris (France), July 11 - 16.

2015 *101st National Congress of the Italian Physical Society*, Sapienza University of Rome, Rome (Italy), September 21 - 25.

2015 School *Spring College on the Physics of Complex Systems*, ICTP, Trieste (Italy), May 21 - June 19.

2014 School *Nonequilibrium Statistical Mechanics and Active Matter*, Beg Rohu (France), September 8 - 20.

Oral contributions, seminars, posters

2018 Seminar "*V-gene insertions and deletions during the affinity maturation process in BCR repertoires*"
- École Normale Supérieure, Paris (France), October 23.
- *3rd course on Multiscale Integration in Biological Systems*, Institut Curie, Paris (France), November 7 - 13.

2018 Poster "*V-gene insertions and deletions during the affinity maturation process in BCR repertoires*"
- *3rd course on Multiscale Integration in Biological Systems*, Institut Curie, Paris (France), November 7 - 13.
- *2nd meeting on Stochasticity and Control in Adaptive Immune Repertoires*, Institut des Systèmes Complexes, Paris (France), October 28 - 31.
- *2nd annual meeting/discussion forum on Physical concepts and computational models in immunology*, École Normale Supérieure, Paris (France), September 26 - 28.
- Workshop *Disordered serendipity: a glassy path to discovery*, Sapienza University of Rome, Rome (Italy), September 19 - 22.
- Workshop *Stochastic models of evolving populations: from bacteria to cancer*, ICMS, Edinburgh (Scotland), July 16 - 20.

2018 Seminar "*The evolution of BCR repertoires during affinity maturation: a statistical mechanics approach*"
- École Normale Supérieure, Paris (France), April 11.

2017 Seminar "*Critical properties of disordered XY model on sparse random graphs*"
- Sapienza University of Rome, Rome (Italy), November 27.

2017 Communication "*Continuous variables on sparse graphs: a boost toward replica symmetry breaking*"
- *FisMat 2017*, ICTP-Sissa, Trieste (Italy), October 1 - 5.
- *103rd National Congress of the Italian Physical Society*, University of Trento, Trento (Italy), September 11 - 15.
- *22nd National Conference on Statistical Physics and Complex Systems*, University of Parma, Parma (Italy), June 28 - 30.

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2016 Poster "*Vector Spin Glasses in a Magnetic Field on Sparse Random Graphs*"
- School *Concepts and Methods of Statistical Physics*, Beg Rohu (France), August 22 - September 3.
- *StatPhys 2016*, Palais Des Congres, Lyon (France), July 18 - 22.
- *Statistical Physics Methods in biology and computer sciences. A satellite meeting of StatPhys 2016*, École Normale Supérieure, Paris (France), July 11 - 16.

2015 Poster "*Instabilities of Vector Spin Glasses in a Magnetic Field*"
- School *Spring College on the Physics of Complex Systems*, ICTP, Trieste (Italy), May 21 - June 19.

Languages

Italian	Mothertongue	
English	Advanced	
French	Intermediate	*Courses at the Institut Français Centre Saint-Louis of Rome (Italy) and at the Alliance Française of Paris (France)*

Computer skills

Operative systems	Mac OSX, Linux, Windows
Programming languages	C (advanced level), CUDA, R, bash, awk, python
Other softwares	MATHEMATICA, ArPack, LaTeX processors, Gnuplot, Microsoft Office package and similar

Publications

In preparation

5 Cosimo Lupo, Giorgio Parisi, Federico Ricci - Tersenghi: "*Exact computation of soft modes in inherent structures for the disordered XY model*"

Preprints

4 Cosimo Lupo, Giorgio Parisi, Federico Ricci - Tersenghi: "*The random field XY model on sparse random graphs shows replica symmetry breaking and marginally stable ferromagnetism*", arXiv 1902.07132 (2019)

3 Cosimo Lupo: "*Critical properties of disordered XY model on sparse random graphs*", PhD Thesis (2017)
- arXiv 1706.08899
- `https://giga.phys.uniroma1.it/LOTGLASSY/PDFS/2017-1493974892.pdf`

Appeared on peer-reviewed journals

2 Cosimo Lupo, Federico Ricci - Tersenghi: "*Comparison of Gabay–Toulouse and de Almeida–Thouless instabilities for the spin-glass XY model in a field on sparse random graphs*", Physical Review B 97, 014414 (2018)

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1 Cosimo Lupo, Federico Ricci-Tersenghi: "*Approximating the XY model on a random graph with a q-state clock model*", Physical Review B 95, 054433 (2017)

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