



Ilaria Maccari

Curriculum Vitae

Education and Training

- 2010–2013 **Master Degree in Theoretical Physics**, "La Sapienza" University, Rome (Italy).
Final Grade: 110/110 cum Laude
- 2007–2010 **Bachelor's Degree in Physics**, "La Sapienza" University, Rome (Italy).
Final Grade: 110/110 cum Laude
- 2002–2007 **High School Diploma**, Liceo Scientifico "I. Newton", Rome (Italy).
Final Grade: 100/100

Bachelors Thesis

Supervisors Prof. Sergio Caprara
Title *Boltzmann's contribution to the problem of irreversibility*

Master's Thesis

Title *Statistical Mechanics of Superconducting Islands in 2D*
Supervisors Prof. Vincenzo Marinari
Description The object of the work was the numerical study of a system of interacting two-dimensional islands of XY spins. The model was suggested to account for the phenomenology in experiments on tunable arrays of proximity coupled long superconductor- normal metal- superconductor junctions. The reference of the publication is: doi:10.1140/epjb/e2016-70171-x.

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Work Experience

11/2014– **PhD Position, "La Sapienza" University, Rome (Italy).**

Present **Supervisors:** Dr. Lara Benfatto and Prof. Claudio Castellani.

Group of research: CLC group of Condensed Matter.

Research activity: My research activity concerns the study of superconducting thin films and artificial nanostructures. During my PhD thesis I have investigated the effect of electron inhomogeneity on the typical signatures of Berezinskii-Kosterlitz-Thouless (BKT) physics. This issue is raised by the recent developments in the fields of strongly-disordered superconductors, where an inhomogeneous superconducting phase spontaneously emerges as the superconductor-insulator transition is approached. Hence, by means of Monte Carlo simulations on the XY model, we focused on the effects of quenched disorder on the universal jump of the superfluid stiffness. In particular, we have shown that the presence of spatially correlated disorder modifies the nucleation mechanism for vortex-antivortex pairs, leading to a considerable smearing of the universal superfluid-density jump as compared to the paradigmatic clean case, in agreement with experimental observations. Together with the spatial correlated disorder, we have also studied the effects of spatial uncorrelated disorder on the response functions of the system. We have derived an effective medium theory for the spatially uncorrelated disordered XY model, from which both the zero temperature value and the low temperature trend of the main observables can be analytically evaluated. The paper will be soon available on arXiv. The further step of this work is the study of the disordered XY model in the presence of a transverse magnetic field, whose principal effect is to force the creation of vortices at low temperature.

The second part of my PhD thesis is in continuity with my Master Thesis, where I studied superconducting systems in which the inhomogeneity is artificially built. In the last years, there have been different experimental works investigating the transport properties of artificial structures of superconducting islands placed on a metallic substrate. The results of these works are of great interest especially because a clear theoretical explanations of their main results is still missing. A deep theoretical characterization of these systems is indeed the aim of the second topic I'm working on. Our approach to this problem is to study more rigorously the effects induced by the proximity effect on the transition. So far we analyzed the anti-proximity effect of a metallic layer on the critical temperature of a superconducting one. We derived an analytical expression that provides a good description of existing data, and we are now working to model accurately the island geometry.

10/2013– **PhD Position, "Saarland University", Saarbrücken (Germany).**

10/2014 **Supervisor:** Prof. Heiko Rieger

Group of research: Group of Statistical Physics.

Research activity: The project I worked on was focused on the study of the T-lymphocyte activation. We have studied this phenomenon through a reaction-diffusion model implemented in the simulation software *COMSOL Multiphysics*. The link of our publication is: doi:10.1016/j.ceca.2016.06.007.

This experience has been very important for my scientific and personal growth. Nonetheless, during this year of PhD I realized that I was more interested to work on hard condensed matter and collective phenomena. This is why I decided to take part in the PhD competition of the major university of Rome with this address of research. After winning the competition both in "RomaTre" University and "La Sapienza" University, I selected the latter one.

Other work experiences

10/2016– **Tutoring OFA, "La Sapienza" University, Rome (Italy).**

12/2016 Winner of a fellowship for academic teaching and tutoring.

Description: Teaching of basic math to college students proved insufficient to the scientific entrance test.

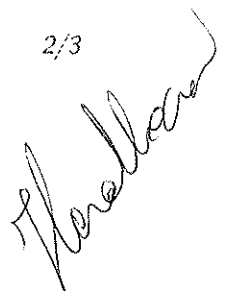
10/2015– **Tutoring OFA, "La Sapienza" University, Rome (Italy).**

12/2015 Winner of a fellowship for academic teaching and tutoring.

Description: Teaching of basic math to college students proved insufficient to the scientific entrance test.

2009 **Assistant and Animator at "Italian Math Festival", Auditorium Parco della Musica of Rome, Rome, (Italy).**

Explanation and discussion of physical experiments and math curiosities.



- 2007 **Assistant at "Italian Science Festival"**, Auditorium Parco della Musica of Rome, Rome, (Italy).
Presentation and discussion of a physical experiment.

List of Publications

- Eur. Phys. J. B 89: 127 (2016).** I. Maccari, A. Maiorano, E. Marinari and J. J. Ruiz-Lorenzo. "A numerical study of planar arrays of correlated spin islands" link: <http://dx.doi.org/10.1140/epjb/e2016-70171-x>
- Cell Calcium 60 (5):309-321 (2016).** I. Maccari, R. Zhaob, M. Peglow, K. Schwarz, I. Hornak, M. Paschec, A. Quintana, M. Hoth, B. Qu, H. Rieger. "Cytoskeleton rotation relocates mitochondria to the immunological synapse and increases calcium signals." link: <http://dx.doi.org/10.1016/j.ceca.2016.06.007>
- Phys. Rev. B 96, 060508(R) (2017)** I. Maccari, L. Benfatto, C. Castellani. *Broadening of the Berezinskii-Kosterlitz-Thouless transition by correlated disorder*

Conferences contributions and talks

- August 2017 **SUNSET2017. School on Unconventional Superconductivity: Theory and Experiment**, IESC, Cargèse (Corsica).
Poster contribution.
- April 2017 **ViCoM Seminar**, Technische Universität Wien, Wien (Austria).
Invited talk.
- October 2016 **Tocotronics2016: Fall School and Workshop "Correlated electrons at surfaces and interfaces"**, Würzburg University, Würzburg (Germany).
Poster contribution.
- September 2016 **SuperFOX2016: Third Conference on Superconductivity and Functional Oxides**, Politecnico, Torino (Italy).
Talk contribution.
- August 2015 **School and Workshop on Strongly Correlated Electronic Systems - Novel Materials and Novel Theories**, ICTP, Trieste (Italy).
Poster contribution.
- October 2014 **Cell Physics – SFB Workshop**, Saarland University, Saarbrücken (Germany).
Poster contribution.

Computer Skills

- Programming Language: C, MATHEMATICA, PYTHON, GNU PLOT, BASH
- Software: MATLAB, COMSOL MULTIPHYSICS, XMGRACE
- Operating Systems: Linux, Ubuntu, Windows, macOS

Languages

- Italian: Mother tongue
- English: Proficient user
- French: Independent user
- German: Basic user

