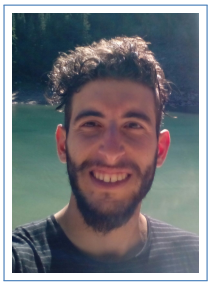

Daniele Tantari

Roma, 14-12-1987

Career and education

2018-2019 **Temporary Assistant Professor, rtd-B**, *University of Florence*, Dipartimento di Scienze per l'Economia e l'Impresa, Firenze.

2018-2019 **Professore a contratto**, Scuola Normale Superiore, Pisa.

2017-2018 **Temporary Assistant Professor, rtd-A**, Scuola Normale Superiore, Pisa.

2015-2017 **Junior Visiting Position**, *Centro Ennio De Giorgi*, Scuola Normale Superiore, Pisa.

2014 **PhD degree in Mathematics**, *La Sapienza University*, Roma, 19-12-2014.

- Thesis title: "Statistical mechanics of multitasking networks"
- Supervisors: Prof. F.Guerra, Dr. A. Barra, Dr. E. Agliari

2011 **Master's degree in Theoretical Physics**, *La Sapienza University*, Roma, 110/110 cum laude.

- Specialization in Statistical Mechanics of Disordered Systems.
  Lectures of Specialization:
  - Fisica dei Sistemi Disordinati, Prof E.Marinari
  - Fisica dei Processi Stocastici e Applicazioni in Fisica, Prof. G.Jona Lasinio
  - Meccanica Statistica, Prof. F.Guerra
  - Fisica dei Sistemi Dinamici, Prof. A.Vulpiani
  - Metodi numerici per la Fisica, Prof. A.Crisanti
- Thesis title: "Gaussian Spin Glasses"
- Supervisor: Prof. F.Guerra.

2009 **Bachelor's degree in Physics**, *La Sapienza University*, Roma, 110/110 cum laude.

- Thesis title: "L' approssimazione di Born-Oppenheimer dipendente dal tempo in fisica molecolare."
- Supervisor: Prof. G.Panati, Researcher at Department of Mathematics.

2006 **Science education**, *Liceo Scientifico L.Spallanzani*, Tivoli (RM), 100/100.

Teaching experience

- "Quantitative Risk Management", DISEI, UniFi, 2018-2019
- "Introduzione ai sistemi dinamici I", SNS, 2018-2019

- "Introduzione ai sistemi dinamici II", SNS, 2018-2019
- "Financial Analysis and Portfolio theory", phD course at SNS, 2018-2019
- "Mathematical Finance", phD course at SNS, 2018-2019
- "Big Data for Business: Statistical methods for financial networks; Unsupervised learning and statistical mechanics", 7h-cycle of seminars, Università di Pisa, July 2018.
- "Statistical Methods for Data Science", master course, Università di Pisa, 2017-2018
- "Mathematical Finance", phD course at SNS, 2017-2018
- "Financial Analysis", phD course at SNS, 2017-2018
- "Time Series and Networks" phD course at Scuola Normale Superiore: lectures on "Cavity method for community detection", (Feb. 2016, April 2017)
- Lecture on "Statistical methods for social action" for phD students in "Scienze politiche e Sociologia" at Scuola Normale Superiore, (Dec. 2015)
- Supervision of master thesis:
  - T.Mauceri, S.Carlotti, Università di Firenze, DISEI (2019)
  - N.Pedreschi: 2018, Università di Pisa, Fisica, "Community detection in dynamic networks: phase transitions and online inference";
  - A.Brini: 2018, Università di Firenze, Finance and Risk Management , "Beyond the parameters estimation burden: a Bayesian framework for option pricing";
  - D.Migliozzi: 2018, Roma Sapienza, Matematica, "Reti neurali associative non-convesse";
  - G.L.Baldi: 2018 Roma Sapienza, Matematica, "Apprendimento senza supervisione mediante Restricted Boltzmann Machines";
  - A.Pizzoferrato: 2014, Roma Sapienza, Fisica, "Statistical Mechanics of Bipartite Spin Systems"
- Supervision of phD students:
  - L.Ristuccia: ongoing, Scuola Normale Superiore, Finanza Matematica, "Non-stationary Hawkes processes")

Awards, Grants, Professional Experiences

- "Abilitazione Scientifica Nazionale (seconda fascia)" in MAT/07, Mathematical Physics (2018).
- Principal investigator of the project "Dynamic networks: measure, model and mitigate financial risks", funded by Scuola Normale Superiore "Progetti interni annuali", 37kEur (2018)
- Funding for the organization of the workshop *Frontiers in High-Frequency Financial Econometrics*, Scuola Normale Superiore internal grant, 4kEur, (2018)
- Principal investigator of the project "Unsupervised learning with multi-layer Boltzmann machines",

funded by Indam, Starting Grants, 35kEur (2018).

- Member of the project SNS16BLILLO - Financial networks: statistical models, inference, and shock propagation, funded by Scuola Normale Superiore (2016)

- Principal investigator of the project "Networks with non-convex community structure" funded by "Progetto Giovani 2016", GNFM, Indam.

- Research in pairs on the project "*Replica symmetry breaking in Bipartite spin glasses*" at Mathematical Research Institute of Oberwolfach, 13-26 Nov (2016)

- Winner of the "progetto premiale MATHTECH - CNR - INDAM 2016" with the project "Bayesian survival analysis theory for heterogeneous cohorts in cancer research."

- Principal investigator of the project GR15ATANTARI "Statistical mechanics of multitasking neural networks as multipartite spin systems" funded by Scuola Normale Superiore "Progetti interni 2015 per giovani ricercatori".

- 2015-Highlights of IOP (best papers of 2015) with the paper "Meta-stable states in the hierarchical Dyson model drive parallel processing in the hierarchical Hopfield network".

- Principal investigator of the project "Reti Neurali gerarchiche" funded by the Universitá La Sapienza di Roma "Progetti Avvio alla ricerca" (2014).

- Member of the project "Calcolo Parallelo Molecolare: risultati rigorosi tra Meccanica Statistica disordinata e Teoria dei grafi sottopercolati" , funded by GNFM Indam, Progetti Giovani (2014).

- 2014-Highlights of IOP (best papers of 2014) with the paper "About a solvable mean field model of a gaussian spin glass,"

- 2013-Highlights of IOP (best papers of 2013) with the paper " Immune networks: Multitasking capabilities near saturation".

- Member of the project "Barra 2013", funded by GNFM Indam, Progetti Giovani (2013).

- May 2011-July 2011, London. Visiting Student at King's College, Department of Mathematics (working with Prof. A.C.C Coolen and Dott. A.Annibale).

Research

Research interests

- *Random financial networks, Dynamic networks, Community detection:* I'm interested in the application of random networks to the study of financial networks: interbank networks, networks of payments, networks of investors, networks of correlations built from time series. In a static perspective I'm interested in the problem of extracting structural informations and inferring macroscopic network structures: communities, hierarchies, core-periphery and bipartite structures. In a dynamical perspective I'm interested both in the study of dynamical processes living on

networks (risk/default propagation) than in the modeling of dynamic networks, where links and topology change in time, aimed at finding non-stationary dynamical patterns and at link forecasting.

- *Neural networks, unsupervised learning:* I'm interested in the study of techniques of unsupervised learning, from Restricted Boltzmann Machines to Deep Learning, from a theoretical point of view. It is possible to study the performances of this techniques and their statistical relevance in relation to the properties of the data training-set and the shape of the learning architecture.

- *Statistical Physics, Complex Systems, Phase transitions, Emergent behaviors, multipartite systems:* I'm interested in the study of the emergent properties in systems of interacting agents, using techniques from statistical physics of complex systems and critical phenomena. In particular I extended the theory of disordered systems for mean field spin glasses to disordered multipartite systems leveraging on their equivalence with neural networks for associative memory. Multipartite systems are useful for modeling real systems of agents, from biological to social systems.

Submitted papers

1. C.Campajola, F.Lillo, D.Tantari, *Inference of the Kinetic Ising Model with Heterogeneous Missing Data*, arXiv:1809.08843 (2018)

2. P.Mazzarisi, P.Barucca, F.Lillo, D.Tantari, *A dynamic network model with persistent links and node-specific latent variables, with an application to the interbank market*, arXiv:1801.00185, submitted to European Journal of Operational Research. (2018)

3. M.Wilinski, P.Mazzarisi, F.Lillo, D.Tantari, *Detectability of Macroscopic Structures in Directed Asymmetric Stochastic Block Model*, arXiv preprint arXiv:1811.04209, submitted to Phys. Rev. E (2018)

Published Papers

1. P.Barucca, F.Lillo, P.Mazzarisi, D.Tantari, *Disentangling group and link persistence in Dynamic Stochastic Block models*, J. Stat. Mech. 2018 (12), 123407 (2018)

2. E.Agliari, D.Migliozzi, D.Tantari, *Non-Convex Multi-Species Hopfield models*, Journal of Statistical Physics, DOI 10.1007s10955-018-2098-6 (2018)

3. A.Barra, G.Genovese, P.Sollich, D.Tantari, *Phase diagram of Restricted Boltzmann Machines and Generalised Hopfield networks with generic priors*, Phys. Rev. E 97, 022310 (2018)

4. A.Barra, G.Genovese, P.Sollich, D.Tantari, *Phase transition in Restricted Boltzmann Machines with generic priors*, Phys. Rev. E 96, 042156 (2017)

5. G.Genovese, D.Tantari, *Overlap synchronization in multi-partite random energy models*, Oberwolfach Preprint (OWP 2017-13), Journal Statistical Physics 169(6), 1162-1170, DOI 10.1007/s10955-017-1897-5 (2017)

6. J. Rocchi, D. Saad, D.Tantari, *High storage capacity in the Hopfield model with auto-interactions - stability analysis*, Journal of Physics A: Mathematical and Theoretical, Volume 50, Number 46

(2017)

7. E. Agliari, A. Barra, C. Longo, D. Tantari, *Neural Networks retrieving Boolean patterns in a sea of Gaussian ones*, , Journal of Statistical Physics, 168(5), 1085-1104 (2017)

8. E.Agliari, A.Annibale, A.Barra, A.C.C. Coolen, D.Tantari, *Retrieving Infinite Numbers of Patterns in a Spin-Glass Model of Immune Networks*, EPL 117 28003 (2017)

9. E. Agliari, A. Barra, A. Galluzzi, F. Requena-Silvente, D. Tantari *Assessing the role of migration as trade-facilitator using the statistical mechanics of cooperative systems*, Palgrave Communications 2, 16021 (2016)

10. G.Genovese, D.Tantari, *Non-convex multipartite ferromagnets*, Journal of Statistical Physics, 163-3, pp 492-513, DOI: 10.1007/s10955-016-1482-3 (2016)

11. P.Barucca, D.Tantari, F.Lillo, *Centrality metrics and localization in core-periphery networks*, J. Stat. Mech. 023401(2016)

12. A. Galluzzi, F. Guerra, D. Tantari, *Universality for couplings correlation in mean field spin glasses*, Book of proceedings "Theory and Applications in Mathematical Physics - In Honor of B. Tirozzi's 70-th Birthday, 49-64, World Scientific doi: 10.1142 9789814713283 0004 (2016)

13. E. Agliari, A. Barra, A. Galluzzi, M. Javarone, A. Pizzoferrato, D. Tantari *Emerging Heterogeneities in Italian Customs and Comparison with Nearby Countries*, PLOS ONE 10(12): e0144643. doi:10.1371 journal.pone.0144643 (2015)

14. E. Agliari, A. Barra, A. Galluzzi, F. Guerra, D. Tantari, F. Tavani, *Retrieval Capabilities of Hierarchical Networks: From Dyson to Hopfield*, Phys. Rev. Lett. 114, 028103 (2015).

15. E. Agliari, A. Barra, A. Galluzzi, F. Guerra, D. Tantari, F. Tavani, *Meta-stable states in the hierarchical Dyson model drive parallel processing in the hierarchical Hopfield network*, J. Phys. A: Math. Theor. 48 (2015) 015001.

16. E. Agliari, A. Barra, A. Galluzzi, F. Guerra, D. Tantari, F. Tavani, *Hierarchical neural networks perform both serial and parallel processing*, Neural Networks Volume 66, 22-35 (2015).

17. G.Genovese, D. Tantari, *Legendre Duality of Spherical and Gaussian Spin Glasses*, Mathematical Physics, Analysis and Geometry, Volume 18, Issue 1 (2015).

18. E. Agliari, A. Barra, A. Galluzzi, F. Guerra, D. Tantari, F. Tavani, *Topological properties of hierarchical networks*, Phys. Rev. E 91, 062807 (2015)

19. A. Barra, G. Genovese, F. Guerra, D. Tantari, *About a solvable mean field model of a gaussian spin glass*, J. Phys. A: Math. Theor. 47 (2014)

20. E.Agliari, A. Barra, G.Del Ferraro, F.Guerra, D.Tantari, *Anergy in self-directed B lymphocytes*

from a statistical mechanics perspective, Journal of Theoretical Biology Volume 375, Pages 1-124 (21 June 2015) Theories and Modeling of Autoimmunity

21. A. Barra, P.Contucci, E.Mingione, D.Tantari, *Multi-species mean-field spin-glasses. Rigorous results*, Annales Henri Poincaré 16 (2015) 691-708.

22. A.Barra, A. Galluzzi, F. Guerra, A. Pizzoferrato and D. Tantari, *Mean field bipartite spin models treated with mechanical techniques*, Eur. Phys. J. B 87: 74 (2014)

23. A.Barra, A. Galluzzi, A. Pizzoferrato and D. Tantari, *A walk in the statistical mechanical formulation of neural networks*, Contribute to the proceeding of the conference: NCTA (2014).

24. P.Sollich, D. Tantari, A.Annibale, A.Barra *Extensive parallel processing on scale free networks*, Phys. Rev. Lett. 113, 238106 (2014).

25. E.Agliari, A.Annibale, A.Barra, A.C.C Coolen, D.Tantari, *Immune networks: multi-tasking capabilities near saturation*, J. Phys. A: Math. Theor. 46 415003 (2013).

26. E.Agliari, A. Barra, A.Galluzzi, A.Pizzoferrato, D.Tantari, *Ferromagnetic models for cooperative behavior: Revisiting Universality in complex phenomena*, proceedings of the Conference "Mathematical models and methods for Planet Heart", INdAM (2013)

27. A.Barra, G.Del Ferraro, D.Tantari, *Mean field spin glasses treated with PDE techniques*, The European Physical Journal B 86:332 (2013).

28. E.Agliari, A.Annibale, A.Barra, A.C.C Coolen, D.Tantari, *Immune networks: multi-tasking capabilities at medium load*, J. Phys. A: Math. Theor. 46 335101 (2013).

29. A. Barra, F. Guerra, G. Genovese, D.Tantari, *How glassy are neural networks?*, J. Stat. Mech. P07009, (2012).

Reviewer for Scientific Reviews

1. Frontiers in Blockchain (Financial Blockchain) (Reviewer Editor)
2. Frontiers in Physics (Social Physics) (Reviewer Editor)
3. Scientific Reports
4. Data Mining and Knowledge Discovery
5. Physical Review Letters
6. Physical Review E
7. Decisions in Economics and Finance
8. Quality and Quantity
9. International Journal of Modern Physics C
10. Applied Soft Computing

Conference and Workshop

- (2012) 23-24 Febr, Roma, *Spin Glass Identities: Workshop on Mathematical Physics Aspects of Disordered Systems*, La Sapienza.
- (2012) 21-22 May, London, *Conference on Statistical Mechanics of Glassy and Disordered Sys-*

tems, King's College.

- (2012) 27-29 Sept, Roma, *Five decades of Theoretical Physics: Looking forward looking backward. Conference in honor of Francesco Guerra seventieth birthday*, La Sapienza.
- (2012) 15 Nov, Roma, *Mini Workshop on Physicist Investigation in Immunology*, talk "Anergy in self-directed B lymphocytes (from a statistical mechanics perspective)", La Sapienza University.
- (2013) 27-29 May, Roma, *Mathematical models and methods for planet earth*, Istituto Nazionale Alta Matematica (INDAM).
- (2013) 24-26 June, Parma, *XVII Convegno Nazionale di Fisica Statistica e dei Sistemi Complessi*, invited speaker, talk: "Retrieving an infinite number of patterns in a spin glass model of the immune system".
- (2013) 8-12 July, Roma, *Mathematics and Quantum Physics*, Accademia Nazionale dei Lincei.
- (2013) 16-20 Sept, Barcelona, *European Conference of Complex Systems 2013*, one day-satellite *Modelling the Complexity of the Immune System*, invited with the poster ""Anergy in self-directed B lymphocytes" .
- (2013) 23-25 Sept, Roma, *Large deviations and rare events in physics and biology*, La Sapienza, invited with a poster "Anergy in self-directed B lymphocytes (from a statistical mechanics perspective)".
- (2014) 15-16 May, Montecatini, *Assemblea nazionale Gnfm*, talk "Modeling networks in the immune system through statistical Mechanics".
- (2014) 22-23 May, Roma, *Biophysics@Rome2014*, invited with a poster.
- (2014) 20-25 July, Banff, *Spin Glass and related topics*, invited speaker.
- (2014) 18-20 Sept, Roma, *70-th birthday of Brunello Tirozzi: Mathematical Physics and applications*, La Sapienza, organizer.
- (2014) 14-27 Sept, Ravello, *Scuola estiva di Fisica Matematica*.
- (2015) 05-09 Jan, Marseille, School *Disordered systems, random spatial processes and applications*
- (2015) 26-30 Jan, Paris, Workshop *Statistical Physics Methods in Social and Economic Systems*
- (2015) 07-08 Apr, Milano, Invited Speaker in Unicredit R & D
- (2015) 24 Aug - 5 Sept, The Beg Rohu Summer School, *Statistical Physics, Biology, Inference and Network*
- (2016) 18-24 Jan, Zurich, invited at Institut fur Mathematik, Universitat Zurich.
- (2016) 28-29 Jan, Pisa, *XVII Workshop on Quantitative Finance*.
- (2016) 18-22 July, Lyon, *StatPhys Conference*, invited with a poster *Retrieval capabilities of generalized Boltzmann machines*.
- (2017) 26 Feb-03 Mar, Les Houches, *Workshop on Statistical physics, Learning, Inference and Networks*, invited with a poster *Restricted Boltzmann Machines with generic priors as Generalised Hopfield Networks*.
- (2017) 04-06 May, Montecatini, *Assemblea Scientifica GNFM*, invited speaker.
- (2017) 15 Sept, Pisa, *Jotto Fair - La ricerca incontra le imprese*, invited speaker.
- (2017) 11 Oct, Firenze, *Big Data and Its Application in an Inter-Disciplinary Context*, European University Institute, invited speaker.
- (2017) 1 Dec, Roma, Università di Tor Vergata, invited talk: *Random model for financial networks*.
- (2018) 13-15 Sept, Napoli, AMASES Annual Conference, Session *Networks and Big Data in Economics, Finance, and Social Systems*, invited speaker: title: *Detectability of Macroscopic Structures in Directed Networks*
- (2018) 28-29 Sept, Pisa, Scuola Normale Superiore, *Frontiers in High Frequency Financial Econometrics*, organizer.

- (2018) 15-19 Oct, Catania, University of Catania, International School on Informatics and Dynamics in Complex Networks, invited speaker.
- (2018) 26 Oct, Firenze, Inaugural Lecture MSc in Finance and Risk Management, invited talk: *Macroscopic Structures in Financial Networks*.
- (2019) 23-25 Jan, Zurich, ETH, Quantitative Finance Workshop 2019, invited talk: *A dynamic network model with persistent links and node-specific latent variables, with an application to the interbank market*.
- (2019) 30 Jan, Bologna, Prometeia, invited seminar: *Random models for financial networks: an application to the interbank market*.

Miscellaneous

Computer skills

- Good knowledge of operating systems Unix and Windows.
- Good knowldge of languages C, C++, Python, R, Mathematica, Matlab.