Marc Mézard

Research summary

The stem of Marc Mézard's research is the statistical physics of disordered systems. Together with his collaborators, he has made seminal contributions to the theory of spin glasses and structural glasses,

Marc Mézard has been a pioneer and leading figure in applying concepts and methods (notably the replica method as well as the cavity method that he co-invented) from physics to other disciplines. Already in the 80's he studied emergent properties and learning in neural networks, and started the first statistical physics studies in computer science (combinatorial optimization).

The works of Marc Mézard range from disordered systems in physics, (pinning of random interfaces - manifolds, aging dynamics and modification of the fluctuation dissipation theorem in spin glasses and other disordered systems, level correlations in disordered electronic systems, theory of structural glasses, disordered superconductors…) to the interface of physics and biology (theory of heteropolymers and their elongation properties, neural networks,…), to information theory and computer science (error correcting codes, satisfiability of random Boolean formulae, group testing, broadcast and reconstruction, compressed sensing,…), and also to econophysics (wealth condensation, order books dynamics).

Curriculum vitae

Director, Ecole normale supérieure, 45 rue d'Ulm, 75005 Paris, France
Born : August 29, 1957

Education

Ecole Normale Supérieure (Paris)	Physics	Master 1978
Ecole Normale Supérieure (Paris)	Theoretical Physics	Thèse 3eme cycle 1980
Ecole Normale Supérieure (Paris)	Statistical Physics	Thèse Etat 1984
Rome University	Statistical Physics	Postdoctoral fellow 1984-1986

Appointments

Director, Ecole Normale Supérieure (Paris)	2012-present
Research Director at CNRS and Director of LPTMS, Université Paris Sud	2010-2012
Visiting Scientist, Oldenburg University	2009-2010
Research Director, CNRS, Université Paris Sud	1999-2010
Visiting Scientist, KITP, Santa Barbara	1998-1999
Research Director, CNRS, Laboratoire de Physique Théorique ENS	1989-1998
Post-doc, Università di Roma *La Sapienza*	1984-1986
Chargé de Recherche, CNRS , Laboratoire de Physique Théorique ENS	1981-1989

Distinctions

2012 : Elected to the European Academy of Sciences
2009 : Humboldt Gay-Lussac award of the Humboldt foundation
1996 : Prize « Ampère » of the french Academy of Sciences
1990 : Silver medal of CNRS

- *On the nature of the spin glass phase*, Mézard, Parisi, Sourlas, Toulouse, Virasoro, Phys. Rev. Lett. 52 (1984) 1156
- "The simplest spin glass", D. Gross and M. Mézard, Nucl. Phys. B240 [FS12] (1984) 431.
- *Replicas and optimization*, M. Mézard and G. Parisi, J. Physique Lett. 46 (1985) L771
- "SK model : the replica solution without replicas", M. Mézard, G. Parisi and M.A. Virasoro, Europhys. Lett. 1 (1985) 77.
- *Learning in feedforward layered networks: the tiling algorithm*, M. Mézard and J.P. Nadal, J.Physics A22 (1989) 2191.
- *Replica field theory for random manifolds*, M. Mézard and G. Parisi, J. Phys. I 1 (1991) 809.
- *Thermodynamics of glasses: a first principle computation*, M. Mézard and G. Parisi, J. Phys. Condens. Matter 11 (1999) A157-A165.
- "Wealth condensation in a simple model of economy", J.-P. Bouchaud and M. Mézard, Physica A, 282, 536 (2000).
- *The Bethe lattice spin glass revisited*, M. Mézard and G. Parisi, Eur. Phys. J. B 20 (2001) 217
- *Analytic and Algorithmic Solution of Random Satisfiability Problems*, M. Mézard, G. Parisi, R. Zecchina, Science 297 (2002) 812
- *The random K-satisfiability problem: from an analytic solution to an efficient algorithm,* Marc Mézard, Riccardo Zecchina, Phys. Rev. E 66 (2002) 056126.
- *Lattice Glass Models*, G.Biroli and M. Mézard, Phys. Rev. Lett. 88 (2002) 025501.
- *Survey propagation: an algorithm for satisfiability*, A. Braunstein, M. Mézard, R. Zecchina, Random Structures and Algorithms 27 (2005) 201-226
- *Clustering of solutions in the random satisfiability problem*, M. Mézard,T. Mora, R. Zecchina, Phys.Rev.Lett. 94 (2005) 197205
- *Reconstruction on trees and spin glass transition*, Marc Mézard, Andrea Montanari, cond-mat/ 0512295, J. Stat. Phys. 124 (2006) 1317-1350
- *Statistical physics-based reconstruction in compressed sensing,* Florent Krzakala, Marc Mézard, Francois Sausset, Yifan Sun and Lenka Zdeborova, Phys. Rev. X 2 (2012) 021005
- *Belief Propagation Reconstruction for Discrete Tomography*, Emmanuelle Gouillart, Florent Krzakala, Marc Mézard, Lenka Zdeborova, Inverse Problems 29, 3 (2013) 035003.

Bibliometric indices

More than 170 publications in international refereed journals, one patent.
8700 citations and h-index=52 (according to ISI Web of Knowledge)
19000 citations and h-index=65 (according to Google Scholar)
(NB The book *Spin glass theory and beyond* has received alone more than 4000 citations, counted by GS but not by WoK).

Synergistic Activities (selection)

- Leader, ANR Grant « QuDEC » on Quantum decoherence (2012)
- Participant, ANR Grant « QPPRJCCQ » lead by B. Douçot on Quantum Computing (2010)
- Participant, ANR Grant ``UNLOC'' lead by D. Simon on Constraint Satisfaction Problems (2009)
- Principal coordinator of a European ``Research training network » of 10 European laboratories (2002-2006)
- Principal coordinator of a European ``Human Capital and Mobility » network of 13 European laboratories (1993-1997)
- Chief Scientific Director, « Journal of Statistical Mechanics: Theory and Experiment (JSTAT) » 2009-present

- Previously editor of Europhysics Letters, Physica A, International Journal of Neural Networks, Complexus, Journal of Statistical Physics
- Seminar organizer, LPTMS Orsay 2000-2007
- Co-Organizer, Les Houches Summer School on « Complex systems », 2006

Collaborators and other affiliations

Professor, Ecole Polytechnique (1987-2012)
Recent collaborators: I Ohta (Tokyo), L. Zdeborova (Saclay), F. Krzakala (ENS), P. Zhang (ESPCI), E. Gouillart (St Gobain), Y. Kabashima (Kyoto), E. Cuevas (Murcia), M. Feigelman (Moscow), L. Ioffe (Paris 6), J. Barbier (ESPCI), R. A. Neher (Tübingen), M. Vucelja (NYU), F. Sausset (St Gobain), Y. Sun (ESPCI), O. Melchert (Oldenburg), A Hartmann (Oldenburg), J. Hertz (Copenhaghen), Y. Roudi (Stockholm), E. Bertin (Lyon), P. Abry (Lyon), G. Parisi (Rome), M. Tarzia (Paris 6), F. Zamponi (ENS), C. Toninelli (Paris 6), B. Shraiman (Santa Barbara)
***PhD supervised (14)*:** W. Krauth, J. Yedidia (one year), R. Monasson, I. Kocher, A. Hazareesing, A. Barrat, M. Müller, M. Ratieville, O. Rivoire, T. Mora, L. Zdeborova, M. Castellana, J. Sakellariou, A. Lokhov