5 juin 2020

CURRICULUM VITAE

Bernard DERRIDA
birth 12.12.52 in El-Biar (Algeria)
citizenship French
married, three children

SCIENTIFIC LIFE

1969 :	Baccalauréat C, mention très bien
1971-1975 :	Ecole Normale Supérieure, rue d'Ulm, Paris
1974 :	Agrégation de Sciences Physiques
1975-1976 :	PhD at CEA-Saclay
1976 :	Thèse de 3ème cycle, Université Paris VI, mention très honorable, "Solution d'un modèle à trois corps : étude de la diffusion" *Solution of a three body problem : the diffusion*
1976-1979 :	PhD at Institut Laue Langevin, Grenoble
1978-1979 :	Military Service
1979 :	Thèse d'Etat, Université Paris XI, mention très honorable, "Effets du désordre et de la frustration dans les systèmes magnétiques. Propriétés critiques des bifurcations de transformations unidimensionnelles" *Effect of disorder and frustration on magnetic systems* *Critical properties of bifurcations of one dimensional maps*
1979-1993 :	Physicien au Service de Physique Théorique du CE-Saclay
1993-2015 :	Professeur à l'Université Paris VI et à l'Ecole Normale Supérieure
Since 2015 :	Professeur au Collège de France, Chaire de Physique Statistique

DISTINCTIONS

1977 :	Prix Daniel Guinier of the French Physical Society
1985 :	Prix IBM
2001 :	Grand Prix Ampère of the French Academy of Sciences
Since 2004 :	Member of the French Academy of Sciences
2007-2015 :	Member of Institut Universitaire de France
2010 :	Boltzmann Medal
Since 2011 :	Member of Academia Europae
2015 :	Prix des Trois Physiciens
2017 :	Chevalier de la Légion d'Honneur

MAIN VISITS ABROAD

Summer 1980 :	IBM, Yorktown, USA
Summer 1981 :	Courant Institute, New York University, USA
Summer 1983 :	UCLA (Los Angeles) et UCSB (Santa Barbara), USA
Spring 1984 :	Weizmann Institute, Israel
Autumn 1985 :	Imperial College, London, UK
Spring 1986 :	Niels Bohr Institute, Copenhagen, Denmark
Summer 1986 :	Institute for Theoretical Physics, UCSB (Santa Barbara), USA
Winter 1986 :	Niels Bohr Institute, Copenhagen, Denmark
Summer 1987 :	Institute for Theoretical Physics, UCSB (Santa Barbara), USA
Spring 1988 :	Institute for Advanced Studies, Jerusalem, Israel
Summer 1988 :	IBM, Bergen, Norway
Autumn 1989 :	School of Mathematics, Institute for Advanced Study, Princeton, USA
Autumn 1990 :	School of Mathematics, Institute for Advanced Study, Princeton, USA
Autumn 1991 :	Weizmann Institute, Israel
Summer 1992 :	Department of Mathematics, Rutgers University, USA
Autumn 1992 :	Department of Physics, Oxford University, UK
Spring 1994 :	Isaac Newton Institute, Cambridge, UK
Summer 1994 :	Department of Mathematics, Rutgers University, USA
Autumn 1995 :	Université de Genève, Suisse
Autumn 1996 :	Department of Mathematics, Rutgers University, USA
Autumn 1997 :	School of Mathematics, Institute for Advanced Study, Princeton, USA
Spring 2001 :	Institute for Theoretical Physics, UCSB (Santa Barbara), USA
Spring 2002 :	School of Mathematics, Institute for Advanced Study, Princeton, USA
Summer 2003 :	Isaac Newton Institute, Cambridge, UK
Spring 2006 :	Isaac Newton Institute, Cambridge, UK
Spring 2007 :	Weizmann Institute, Israel
Spring 2011 :	Technion, Israel
Spring 2012 :	Weizmann Institute, Israel
Summer 2013 :	Higgs Center, University of Edinburgh UK
Autumn 2013 :	School of Mathematics, Institute for Advanced Study, Princeton, USA
Spring 2014 :	Galileo Galilei Institute, Florence, Italy
Summer 2014 :	International Centre for Theoretical Physics, Trieste Italy
Spring 2015 :	Technion, Israel
Spring 2017 :	Weizmann Institute and Technion, Israel
Summer 2017 :	International Center for Theoretical Sciences, Bangalore, India
Summer 2018 :	Institut Solvay, Bruxelles, Belgium
Autumn 2019 :	University of Tokyo, Japan

INVITED TALKS SINCE 1979

Since 1979, about 200 seminars and 200 invited talks at conferences in the following countries :

Algeria :	Alger, Oran
Argentina :	Bariloche
Australia :	Cairns
Austria :	Obergurgl, Vienne
Belgium :	Bruxelles, Louvain
Brazil :	Brasilia, Rio
Canada :	Montreal, Toronto
Chile :	Santiago
China :	Hong Kong, Xiamen
Corea :	Seoul
Denmark :	Arrhus, Copenhagen
France :	Annecy, Beg Rohu, Blois, Bordeaux, Cadarache, Cargèse, Chantilly, Dijon, Grenoble, Les Houches, Lyon, Marseille, Nancy, Nîmes, Nice, Orléans, Rennes, Seillac, Strasbourg
Germany :	Altenberg, Berlin, Bonn, Bremen, Clausthal, Dresde, Duisbourg, Dusseldorf, Heidelberg,Julich, Mainz, Munich, Oberwolfach, Wuppertal
Hungary :	Balaton
India :	Bangalore
Israel :	Beer-Sheva, Haifa, Jerusalem, Rehovot, Tel Aviv
Italy :	Bari, Cortona, Florence, Modène, Noto, Rome, Sienne, Trieste, Turin
Japan :	Tokyo
Marocco :	Rabat
Mexico :	Guanajuato
Norway :	Bergen, Sandefjord
Netherland :	Delft, Leyden, Utrecht
Poland :	Varsovie
Russia :	Moscow, St Petersbourg
Slovakia :	Bratislava
Spain :	Grenade, Madrid, Salamanque, Sitges
Sweden :	Stockholm
Switzerland :	Ascona, Fribourg, Genève, Gwatt, Lausanne, Zurich
Taiwan :	Taipei
Turquie :	Istamboul
UK :	Cambridge, Edinburgh, London, Manchester, Nottingham, Oxford, Swansea, Southampton
USA :	Aspen, Atlanta, Boston, Chicago, Los Angeles, Los Alamos, New Brunswick, New York, Princeton, Santa Barbara, Santa Fe

MAIN FIELDS OF RESEARCH

Dynamical systems and Julia sets
Spin glasses, random energy models
Phase transitions, transfer matrices, finite size scaling, renormalization
Transport in presence of disorder
Disorder in one dimension, Lyapounov exponents, Anderson localisation
Neural networks, Hopfield models, Learning
Random networks of automata, Kauffman model, dynamical phase transitions
Growth, coarsening, persistence, first passage
Directed polymers in random media
Traveling waves, effect of noise, extrema of the Brownian motion
Non-equilibrium systems and exclusion processes : exact solutions, shocks
Large deviations of the density and of the current
Models related to biology : heteropolymers, speciation, selection, genealogies

RESEARCH WORK

During my PhD, my first works at the end of the 70's were devoted to the problem of period doubling, showing with A. Gervois and Y. Pomeau that the phase diagram of logistic maps has infinitely many accumulation points (which generalize the accumulation point characterized by Feigenbaum's universality) and calculating the universal ratios associated to some of these points using methods inspired by real-space renormalisation.

At the same time I started to work on spin glasses. I published at the beginning of the 80's, papers [1] on the random energy model (REM), which appears as a limiting case of a family of models, the p-spin models that I introduced. It took some time before these works were recognised by the spin-glass community as being the simplest non-trivial spin-glass models. The REM and its extensions, the GREM developed in collaboration with the late E. Gardner, were the first models for which the Parisi theory of spin-glasses could be tested by a direct comparison with an exact solution. Since then, the REM, the p-spin models and the GREM have been used to understand a large class of systems ranging from proteins to glasses.

During the 80's, I worked on a number of problems in the theory of disordered systems. I published in 84 with E. Gardner a work on Anderson localisation (to calculate the localisation length of weakly disordered chains, in particular at the band edge and at the band center, where the naive expansion breaks down), a paper in 83 on the calculation of the velocity and the diffusion constant of random walks on random chains (the Sinai problem). In joint works with J. Vannimenus, H. Herrmann, D. Stauffer I developed also in 82-84 a transfer matrix algorithm [2] to calculate the conductivity of random resistor networks. In parallel, in a series of papers with J. Vannimenus, L. De Seze, H. Herrmann, we extended the transfer matrix method to geometrical problems such as self-avoiding walks, polymers, percolation to estimate the critical exponents of these systems using finite size scaling.

At the end of the 80's I started to work on random Boolean networks, such as the Kauffman model, where using the ideas of spin glasses such as overlaps in joint works with Y.Pomeau, G. Weisbuch and H. Flyvbjerg, we could locate exactly the transition from a frozen phase to a chaotic phase that Kauffman had observed 15 years before, trying to analyze numerically his model for cell differentiation. The method developed for Boolean networks was then used, in a joint work [3] with E. Gardner and A. Zippelius, to solve exactly the dynamics of diluted asymmetric networks, an extension of the Hopfield model where the connections between neurons are asymmetric, leading to the first model of neural networks for which the dynamics could be solved exactly. Another contribution to neural networks was a paper in 88 with E. Gardner where we showed that the number of errors made by a network could be thought as an energy, allowing to calculate the minimal number of errors that a network does when it operates beyond perfect learning as the ground state energy of a spin-glass like model. Similar ideas were used later in optimisation problems.

Since the beginning of the 90's, I have mostly worked on non-equilibrium statistical mechanics. First in a series of works started in a joint paper with E. Domany and D. Mukamel, I developed a method to solve exactly one dimensional exclusion process (one of the simplest models of transport between two reservoirs). The best known work on the subject is the 93 solution with M. Evans, M. Hakim, and V. Pasquier [6] of the one dimensional exclusion process with open boundaries using a matrix representation of the steady state, introducing an approach which was used later in many contexts, in particular to calculate shock profiles, and more recently large deviation functionals (an extension to non-equilibrium systems of the concept of free-energy) in joint works [8] with J. Lebowitz and E. Speer. These works were continued in the years 2000 in a series of papers with B. Douçot, P.E.Roche, T. Bodineau, E. Brunet, A. Gerschenfeld, T. Sadhu to study the current fluctuations in non-equilibrium steady states, showing in particular how to calculate exactly the large deviation function of the current for diffusive systems [9,11].

My works on persistence started in 94 , with papers with A. Bray and C. Godrèche, represent another contribution to non-equilibrium physics, with probably as the best known result, obtained in collaboration with V. Hakim and V. Pasquier, the exact calculation of the persistence exponents appearing in the zero-temperature coarsening dynamics of one dimensional chains [6].

Since the end of the 90's, I have been interested with E. Brunet by the effect of noise on traveling waves. The problem originated from the theory of disordered systems but is relevant in other contexts (PDE, Chemistry, Biology). Our first work was to show [7] that the main effect of noise is to to select a single velocity and to play the role of a cut-off. Later on in 86, we got with E. Brunet, A. Mueller and S. Munier [10] a much more precise picture of the effect of fluctuations on traveling waves. Our predictions have been proved by our colleagues mathematicians. Two more recent developments of our works of fronts were the study of the extremal points of a branching Brownian motion and of models of evolution in presence of selection [12].

Since the beginning of the 90's I had an ongoing interest for a simple problem in the theory of disordered systems, the denaturation of DNA in presence of disorder [13]. In 2014 with my student M. Retaux [14], we proposed a toy model which led us to predict an infinite order transition for this denaturation problem. Several mathematical works initiated by Z. Shi have followed to establish this result rigorously and to generalize it [15].

My other present series of works, in collaboration with P. Mottishaw, is an attempt to better understand Parisi's replica approach by looking at finite size corrections, fluctuations and temperature chaos on simple models such as the random energy model or the directed polymer problem [16].

Among my other published contributions to to Statistical Mechanics, I would like to quote my works on Fisher zeroes and their relationship to Julia sets, the KPZ equation and directed polymers in random media.

In addition to the models of evolution with selection, the problem of denaturation of DNA, the Kauffman models and the neural networks, I have been interested since the beginning of the 90's by models related to biology, mostly due analogies with of spin-glasses. This led me to work on problems of genetic diversity, folding of random heteropolymers, genealogies and speciation [4].

1. B. Derrida, *The random energy model, an exactly solvable model of disordered systems* Phys. Rev. B24, 2613 (1981)
2. B. Derrida, J. Vannimenus, *A transfer matrix approach to random resistor networks* J. Phys. A15, L557 (1982)
3. B. Derrida, E. Gardner, A. Zippelius, *An exactly solvable asymmetric neural network model* Europhys. Lett. 4, 167 (1987)
4. P.G. Higgs, B. Derrida, *"Genetic distance and species formation in evolving populations"* J. Mol. Evol. 35, 454-465 (1992)
5. B. Derrida, M.R. Evans, V. Hakim, V. Pasquier, *Exact solution of a 1d asymmetric exclusion model using a matrix formulation* J. Phys. A26, 1493 (1993)
6. B. Derrida, V. Hakim, V. Pasquier, *Exact first passage exponents in 1d domain growth : relation to a reaction-diffusion model* Phys. Rev. Lett. 75, 751 (1995)
7. E. Brunet, B. Derrida, *Shift in the velocity of a front due to a cut-off* Phys. Rev. E 56, 2597 (1997)
8. B. Derrida, J.L. Lebowitz, E.R. Speer *Free energy functional for nonequilibrium systems : an exactly soluble case* Phys. Rev. Lett. 87, 150601 (2001)
9. T. Bodineau, B. Derrida, *"Current fluctuations in nonequilibrium diffusive systems : An additivity principle"* Phys. Rev. Lett. 92, 180601 (2004)
10. E. Brunet, B. Derrida, A. H. Mueller, S. Munier, *"A phenomenological theory giving the full statistics of the position of fluctuating pulled fronts"*
11. B. Derrida, A. Gerschenfeld, *"Current fluctuations of the one dimensional symmetric simple exclusion process with step initial condition"* J. Stat. Phys. 136, 1-15 (2009)
12. E. Brunet, B. Derrida, *"Genealogies in simple models of evolution"* J. Stat. Mech. P01006 (2013)
13. B. Derrida, V. Hakim, J. Vannimenus, *"Effect of disorder on two dimensional wetting"* J. Stat. Phys. 66, 1189-1213 (1992)
14. B. Derrida, M. Retaux, *"The depinning transition in presence of disorder : a toy model"* J. Stat. Phys. 156, 268-290 (2014)
15. X. Chen, V. Dagard, B. Derrida, Y. Hu, M. Lifshits, Z. Shi, *"The Derrida–Retaux conjecture on recursive models"* arXiv :1907.01601
16. B. Derrida, P. Mottishaw, *"On the genealogy of branching random walks and of directed polymers"* EPL 115, 40005 (2016)