Curriculum Vitae (2025) ..... Denis BERNARD

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Personal Information
Name: Denis BERNARD
Date of birth: June 09, 1961
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Professional Preparation
– Habilitation, Physics, Université Paris XI. 1993.
– Ph.D., Theoretical Physics, Université Paris XI. 1987.
– Agrégation de Sciences Physiques, rank: 2^{nd}. 1983.
– Ecole Normale Supérieure, Physics, St Cloud. 1980-1985.

Appointments

2015-present:	Directeur de recherches, classe exceptionnelle, C.N.R.S.
2003-2015:	Directeur de recherches, 1^{st} classe, C.N.R.S.
1995-2003:	Directeur de recherches, C.N.R.S.
1988-1995:	Chargé de recherches, C.N.R.S.
1988-1989:	Post-doctoral Fellow, School of Math., Institute for Advanced Studies, Princeton.
1987-1988:	Post-doctoral Fellow, Physics Department, Princeton University, USA.
In parallel:	
2019-present:	Laboratoire de Physique de l'Ecole Normale Supérieure (LPENS), ENS-Paris.
2006-2019:	Laboratoire de Physique Théorique (LPT-ENS), Ecole Normale Supérieure de Paris.
2002-2016:	Professor (part-time) at Ecole Polytechnique, France.
1995-1996:	Institut des Hautes Etudes Scientifiques (I.H.E.S), France.
1989-2005:	Institut de Physique Théorique (IPhT), Saclay, France.

Awards
– C.N.R.S. Silver Medal, 2004.
– Paul Langevin Prize from the Société Française de Physique, 1998.
– C.N.R.S. Scientific Excellence Award, 2009-2013, 2014-18, 2020-23 and 2024-26.

Synergistic Activities
– Member of the review committee of the Bernoulli Center at EPFL, Lausanne, Switzerland, 2025.
– LPENS deputy director, ENS-Paris, 2019-2024.
– Member of the review committee of the School of Theoretical Physics of Dublin Institute of Advanced Studies, 2024.
– Member of the Scientific Council of the SwissMAP Research Station, Switzerland, 2022-present.
– Member of the Recruitment Commission of the Physics Department of the Ecole Polytechnique, France, 2022-present.
– Member of the Scientific Advisory Committee of the Simons Center for Geometry and Physics, Stony Brook, USA, 2021-present.
– Member of the Advisory Scientific Board of the Erwin Schrödinger Institute, Vienna, 2013-2018.
– LPT-ENS vice-director, Paris, 2010-2014.
– Member of the Stat.Phys.25 Steering Committee, Seoul, 2012.
– Member of the Board of the Physics Department at ENS, Paris, 2011-present.
– Member of the Comité National de la Recherche Scientifique (CoNRS), France, 2004-2008.
– Scientific consultant for the French research minister DGRI, Paris, 2009-2012.
– Member of the Administration Board of the Institut H. Poincaré, Paris, 2004-2009.
– Member of the Scientific Council of the Fédération de Recherche FRIF, Paris, 2009-2013.
– Member of the Scientific Council of the IPhT-Saclay, 1997-1999 and 2001-2005.
– Member or chairman of various evaluation committees (French or foreign laboratories).
– Member or chairman of various search or recruiting committees (in France or abroad, in physics or in math).
– Member or chairman of various Ph.D. and Habilitation jurys.

Memberships of Editorial Board
– Associate Editor of the Journal of Statistical Physics, 2018-present.
– Member of the Editorial Board of the Journal of Physics A [Letter], 2014-2020.
– Member of the Editorial Board of the Annales Henri Poincaré (phys. math.), 2012-2019.
– Member of the Editorial Board of Journal of Statistical Mechanics (theory and experiment), 1999-present.

Grants & **Contracts**
– Simons Collaboration on "Probabilistic Paths to QFT", 2025-2029, PI, $558 000.
– Contract ANR-21-CE40-0003, "CFT: constructive aspects and integrability", 2022-26, Member, 518.832 €.
– Contract ANR-20-CE47-0014, "Stochastic quantum evolutions", 2021-25, Co-PI, 351.864 €.
– Contract ANR-14-CE25-0003, "Stochastic methods in quantum mechanics", 2014-19, Co-PI, 230.000 €.
– Contract ANR-2010-BLANC-0414, "Quantum transport on low dimensions", 2010-14, Member, 187.000 €.
– Contract ANR-BLAN06-3-134462, "Stochastic Loewner Evolutions and applications", 2006-10, PI, 270.000 €.

Thesis & **Post-doctoral Advising**
Ph.D. Students (8):
Didina Serban (Ph.D. in 1996, now researcher at CEA), Nicolas Regnault (Ph.D. in 2001, now DR at CNRS), Loic Estève (2006), Christian Hagendorf (part time, Ph.D. in 2008, now Prof. at UCL Louvain), Tristan Benoist (Ph.D. in 2014, now CR at CNRS), Antoine Tilloy (Ph.D. 2016, now Ass. Prof. at MinesParisTech), Tony Jin (Ph.D. in 2019, now MdC at Univ. Côte d'Azur), Ludwig Hruza (Ph.D. in 2024, now post-doc).
Post-doctoral Fellows (7):
Kalle Kytölä (2006-2008, now Prof. at Aalto Univ.), Luigi Cantini (2008-2010, now Ass. Prof. at Cergy Univ.), Guillaume Palacios (2011-2013, CEO at ZEBRIA), Jacopo Viti (2012-2014, now Ass. Prof. at UFRN Natal Univ.), Andrea De Luca (2012-2014, now CR at CNRS), Ohad Shpielberg (2016-2018, now Lecturer at Haifa Univ.), Stefano Scopa (2024-2026).

Teaching
– At various thematic workshops or schools, on different topics.
– At the ENS/EDPIF Master: *Statistical Field Theory and Applications*, 2016-2021.
– At the ENS: Co-organisation of the math-physics mixed cursus, 2011-2013.
– At the Ecole Polytechnique (France), 2002-2016: *Quantum Mechanics, Statistical Physics, Variational Principle, Special Relativity, Group Theory and Symmetry in Physics.*
– At the IPhT-Saclay: *Integrable systems* (1995), *Turbulence* (1999), *Growth processes* (2005).

Organization of Scientific Meetings (recent, a sample)
– Various thematic conferences or workshops, a few every years.
– Creation of the seminar series, the *Forum de Physique Statistique* and the *Balades Quantiques*, at the ENS.
– GGI school on "Statistical Field Theory", Firenze, Italy, Member of organising or scientific board since 2015.
– Program "Mathematical aspects of quantum integrable models in and out of equilibrium", Newton Institute, Cambridge, UK, Jan. 2016.
– School "SFT-Paris-2019", in partnership with GGI-Firenze, Institut H. Poincaré, Paris, Sept. 2019.
– Program on "Systems Out-of-Equilibrium: Interplay between Statistical, Quantum and Disorder Dynamics", Institut H. Poincaré, Paris, Fall 2020.
– Program on "Fluctuations, Entanglements, and Chaos: Exact Results", SCGP, Sept. 2023.
– Program on "Random paths to QFT: New probabilistic approaches to field theory", SCGP, Oct. 2024.

Talks & **Month-long Visits (recent, a sample)**
Invited or plenary talks in over 150 meetings:
- Invited contributions to conferences/workshops/schools, 3 to 5 per years, in average.

A few named lectures or long term visits (a sample):
- Arnold Sommerfeld Summer Lectures, LMU Munich, 2008.
- Stat.Phys.24 invited speaker, Cairns, Australia, 2010.
- Simon Lectures, Mathematics Dept., Berkeley, 2012.
- Lectures series of the Kadanov Center for Theoretical Physics, Univ. of Chicago, 2015.
- May 2007: Institute for Pure & Applied Mathematics, (IPAM), UCLA, Los Angeles, USA.
- May 2009: James Franck Institute, Chicago Univ., USA.
- March 2012: Mathematical Science Research Institute (MSRI), Berkeley Univ., USA.
- Sept. 2012: Simon Center for Geometry and Physics (SCGP), Stony Brook Univ., USA.
- March 2015: First Visiting Professor at the Kadanov Center for Theoretical Physics, Chicago Univ., USA.
- Sept. 2022: Simon Center for Geometry and Physics (SCGP), Stony Brook Univ., USA.
- Sept. 2024: Simon Center for Geometry and Physics (SCGP), Stony Brook Univ., USA.
- April 2025: Center of Mathematical Sciences and Applications, Harvard Unuiv, USA.

Thematic Mobility
During my career, I worked on different areas of theoretical physics including: Turbulent systems and turbulent transports; Random geometry and random spatial processes; Conformal field theory, integrable systems and applications; Out-of-equilibrium quantum systems.

Research Activities
Conformal Field Theories, Integrable Systems: Structures and Applications.
Conformal field theories (CFT) and integrable systems find applications to 2D phase transitions, to critical quantum systems, and they are closely related to string theories. I have been involved in the development of the CFT methodological tools. Part of my work relies on deciphering and using quantum symmetries, others have a more mathematical flavour related either to algebraic structures and to geometrical aspects of Riemann surfaces.
Turbulent systems, Turbulent Transports.
Turbulent phenomena are ubiquitous in many every day phenomena, but still lack a complete theoretical understanding. I participated to the physical and mathematical collective understanding of intermittence phenomena in the (up-to-now) unique solvable model of turbulent transport, and to enlighten traces of conformal invariance in two dimensional turbulence.
Random Geometry, Random Spatial Processes.
Understanding random fractal patterns is at the core of the comprehension of many physical phenomena or mathematical structures, and the brownian motion is a historical example of such structures. I participated to the understanding of newly constructed planar random curves or interfaces (called SLE), a theme which fits into random geometry. We developed bridges linking probabilistic approaches from mathematicians with those of physicists based on field theories.
Quantum Noises, Open and Out-of-Equilibrium Quantum Systems.
Experimental progresses in controlling quantum systems gave new impetus to study unexplored territory of quantum dynamics, and simultaneously to answer old questions of quantum mechanics. My recent research aims at studying quantum stochastic processes, their mathematical structures and their applications the physics of monitored or open quantum systems, in or out of equilibrium. To decipher the nature of a possible quantum extension of the macroscopic fluctuation theory, I introduced and analysed an iconic model of stochastic quantum many-body dynamics, the quantum symmetric simple exclusion process.
Motivated by curiosity, I also considered problems related to 2D disordered systems, to localisation phenomena, to topological matters, and to facets of semi-classical gravity or to random or genetic networks.

Publications
A complete list of publications is available on my homepage.
Publications posterior to 1991 (refs.[34,84] are missing) can be found at:
`https://arxiv.org/a/bernard_d_1.html`
Bibliometry (2024, Google Scholar): articles=149, citations=11788, h=58.

Collaborators (not mentioning Ph. D. students)
O. Babelon (LPTHE, Paris), M. Bauer (IPhT, Saclay), Ph. Biane (Marne la vallée U.), G. Boffetta (Turin), A. Celani (Nice Univ., now ICTP), A. De Luca (Cergy Univ.), J. De Nardis (Cergy Univ.), B. Doyon (King's College), F. Essler (Oxford U.), G. Falkovich (Wiezmann Inst.), G. Felder (Dept. Math., ETH-Zürich), K. Gawedzki† (IHES, then ENS-Lyon), D. Haldane (Princeton Univ.), A. Kupiainen (Dept. Math., Helsinki Univ.), K. Kytola (Dept. Math., Aalto Univ.), A. LeClair (Cornell Univ.), P. Le Doussal (ENS, Paris), M. Medenjak† (Univ. Geneva), A. Nahum (ENS, Paris), V. Pasquier (IPhT, Saclay), Y. Pautrat (Dept. Math., Orsay), F. Petruccione (Durban Univ.), L. Piroli (Bologne U., then ENS Paris), F. Smirnov (LPTHE, Paris), J. Thierry-Mieg (NIH Washington), etc.

Main research achievements
Conformal field theories: structures and applications (1986-1995):
– Construction of modular invariant partition functions of WZW models using automorphisms of Kac-Moody algebras. This relation between automorphisms and partition functions has since then be generalised to other operator algebras, and the list of partition functions obtained in this way was almost exhaustive. Ref.[7].
– Formulation of the WZW models on the torus and on higher genus Riemann surfaces. It required introducing new degrees of freedom coupled to the moduli space of flat fiber bundles on these surfaces. It lead me to write the now called KZB equations (series of differential equations on the moduli space of flat fiber bundles) which had some echoes in other branches of mathematical physics (integrable systems, geometric quantification, quantum groups,...). Refs.[10,11].
– A mathematical study of free field representations of the su(2) WZW models, which can be used to exactly solve these models. It required resolving some cohomology defined over representation spaces of Kac-Moody algebras. These methods have since then be extended to other classes of CFTs. Ref.[15].

Integrable systems and applications (1989-1997):

– Demonstrating non-local symmetries in 2D quantum field theories reflecting quantum group symmetries (Yangians, quantum affine algebras), and their use to solve integrable perturbations of CFTs. Semi-classical interpretation of these symmetries and their relations with Lie-Poisson groups. These kinds of non-local symmetries have recently reappeared in super-symmetric gauge theories and in connection with Smirnov's holomorphic currents. Refs.[17-19,20,23].

– Exact solution of long range interaction spin models (Calogero and Haldane-Shastry models) whose excitations are spinons with fractional statistics. Discovery of their Yangian symmetries and consequences of those. It lead to a new representation of CFTs in terms of quasi-particles with fractional statistics which had some echoes. Ref.[34,36,40].

– Results on integrable systems, on integrable field theories, and on quantum groups and their representations. Formulation of the first algebraic framework for the dynamical Yang-Baxter equations (we introduced a notion of 'twisted cocycle' which has been re-used in the theory of quasi-Hopf algebra). Refs.[29,48,49,51].

Turbulent systems (1996-2001, then by intermittence-2008):

– Understanding of the physical origin of the deviations from mean field and of the multi-fractality in Kraichann's model of turbulent transports. Beyond computing anomalous dimensions, we were the first to provide an interpretation of these deviations in terms of statistically conserved quantities. A 'News &Views', Nature 409 (2001), mentioned "In recent years there has been a fundamental shift in the theoretical approach to such characteristics of turbulence" quoting [55]. Refs.[50,55].

– Study of the influence of friction on the direct cascade of 2D turbulence. I showed that anomalous dimensions are friction dependent, and this explained differences in some experimental results. Formulation of a conjecture concerning the absence of anomalous enstrophy dissipation in presence of friction, a conjecture which has recently been proved. Ref.[61].

– Discovery of traces of conformal symmetry in the inverse cascade of 2D turbulence obtained by studying statistical properties of iso-vorticity lines. This study constituted the first statistical analysis of non-local structures pointing toward the existence of emergent symmetries in turbulence; cf. 'News & Views', Nature Physics 2 (2006). Ref.[85].

Curves, domains and random geometry (2002-2012):

– Demonstrating the relation between spatial random processes, the so-called SLE, and conformal field theories (CFT). We were the first to establish the link between two intrinsically different approaches, one probabilistic (SLE) and the other algebraic (CFT). Refs.[74,75,77].

– Generalisation of SLEs to n-SLEs describing multiple random curves and their relations with statistical mechanics. This extension lead us to reveal the connection between SLE processes and partition functions, a point of view now shared by quite a few probabilist. Refs.[81,83].

– Extension of the domain of applicability of SLEs to disordered or out-of-equilibrium physical systems (turbulence, spin glasses). Refs.[87,93].

Open quantum systems (2011-present):

– Proofs of typical/a-typical properties of quantum trajectories in quantum monitoring, including progressive collapses in QND measurements, quantum jumps and quantum spikes. Mathematical study of solutions of certain stochastic differential equations in the strong noise limit and their spiky behaviors. Ref.[96, 115,120].

– Non-equilibrium CFTs and a new universal formula for the large deviation function of heat transport in 1D critical systems. Exact formulation of diffusion in hydrodynamics of integrable systems. Ref.[97,103,124].

– Stochastic processes in quantum many-body systems, definition and solution of the quantum simple symmetric exclusion process. Its connection with free probability and its applications towards extending the macroscopic fluctuation theory. to the quantum realm. Refs.[125,127,131,141].

– Derivation of the sigma model description of the measure induced phase transition of monitored free fermions. Refs.[140,144].

A few connexions with mathematics:

Some of my works possess a mathematical flavour:

– On Kac-Moody algebras (vertex operator representations [5], cohomology on certain modules of affine algebras [15], KZB equations [10,11]);

– On quantum groups (Lie-Poisson groups [29], Yangian representations and Dunkl's operators [36], quasi-Hopf algebras and the dynamical Yang-Baxter equations [48]);

– On certain stochastic differential equations (explosive solutions of SDEs [55]; Schramm-Loewner evolution (SLE) [75,76] and its generalisations (n-SLE) [81,83], strong noise limits of SDEs [116,120]);

– Excursion on structured random matrices, free probability and free processes [137,142,149].