Cédric VILLANI: Curriculum Vitae (last updated August 4, 2012)

Professor of the Université de Lyon
Director of the Institut Henri Poincaré
11 rue Pierre et Marie Curie, F-75230 Paris Cedex 05, FRANCE.
Tel.: +33 1 44 27 64 18, fax: +33 1 46 34 04 56. E-Mail: villani@math.univ-lyon1.fr
Internet address: http://math.univ-lyon1.fr/~villani

Personal information

- Born October 5, 1973 in Brive-la-Gaillarde (France); french citizen
- age 38, two children
- languages: french (native), english (fluent), italian
- hobbies: walking, music (piano)

Positions held

- From 2000 to 2010 I have been professor (mathematics) in the École Normale Supérieure de Lyon, where I did research and teaching up to graduate level. In September 2010 I moved to the Université Claude Bernard Lyon I.
- Since July 2009 I am director of the Institut Henri Poincaré (Paris), where I do research and administration. I am the coordinator of the CARMIN structure, which gathers the four international french institutes for mathematics: CIRM, CIMPA, IHP, IHÉS.
- Invited member of the Institute for Advanced Study, Princeton (January–June 2009)
- Visiting Research Miller Professor at the University of Berkeley (January–May 2004)
- Visiting Assistant Professor at the Georgia Tech Institute, Atlanta (Fall 1999)
- Student, then agrégé-préparateur ("tutor") at the ENS, Paris (1992-2000)

Diplomas, titles and awards

- Fields Medal (2010)
- Fermat Prize (2009)
- Henri Poincaré Prize of the International Association of Mathematical Physics (2009)
- Prize of the European Mathematical Society (2008)
- Jacques Herbrand Prize of the Academy of Sciences (2007)
- Invited lecturer at the International Congress of Mathematicians (Madrid, 2006)
- Institut Universitaire de France (2006)
- Harold Grad lecturer (2004)
- Plenary lecturer at the International Congress of Mathematical Physics (Lisbonne, 2003)
- Peccot-Vimont Prize and Cours Peccot of the Collège de France (2003)
- Louis Armand Prize of the Academy of Sciences (2001)
- PhD Thesis (1998; advisor P.-L. Lions); Habilitation dissertation (2000)

Extra-academic distinctions

Knight of the National Order of Merit (2009) and Legion of Honor (2011)

Past scientific and administrative responsibilities

- Director-in-second of my laboratory (2005-2008) (temporary director in Sept-Oct 2005)

- Editor for *Inventiones Mathematicae*, *Journal of Functional Analysis (JFA)*, *Journal of Mathematical Physics (JMP)*, *Journal of Statistical Physics (JSP)*. Former editor of *SIAM Journal of Mathematical Analysis* (2004–2007), *Annals of Institut H. Poincaré* (2006–2008).

- Member of the hiring committees of the ENS Lyon in mathematics (president 2001–2006) and physics (2005–2007); of the Lyon 1 and Grenoble Universities in mathematics

- Scientific officer in charge of the F4 team (Bordeaux, Lyon, Clermont-Ferrand, Rennes, Strasbourg) in the European network Hyke (Hyperbolic and Kinetic Equations), 2002–2005

- Member of various Scientific and Programmation Committees

Research interests

My research activity lies between analysis, probability theory, statistical physics and more recently differential geometry. I invested a lot of research in the kinetic theory of the Boltzmann equation, and optimal transport of measures, two very rich subjects. I presented my results to audiences of analysts, PDEsts, probabilists, geometers, physicists.

Here are some of my results:

• the solution of the "Cercignani conjecture", a functional inequality relateing entropy and entropy production for the Boltzmann equation (in general false, sometimes true, always true in a weakened form; these works partially joint with Giuseppe Toscani).

• the solution of a conjecture by P.-L. Lions about the regularizing effects of grazing collisions in the Boltzmann equation, and the extension of the DiPerna–Lions theory to singular collision kernels (joint works with Radjesvarane Alexandre); beyond this result, my works with Desvillettes and Alexandre were the starting point for the current theory of grazing collisions.

• the first explicit estimates for convergence to equilibrium for very smooth solutions of the Boltzmann equation, without any a priori assumption of smallness of linearization. I developed and generalized these estimates in a so-called "hypocoercive" setting, which triggered many developments in kinetic theory, and some outside.

• the discovery of tight links between certain concentration inequalities due to Talagrand, logarithmic Sobolev inequalities and the study of diffusion equations (in collaboration with Felix Otto). These works have been the starting point of further research by many.

• a new proof of certain optimal Sobolev and Gagliardo–Nirenberg inequalities, based on optimal transport (work in collaboration with Dario Cordero-Erausquin and Bruno Nazaret). I developed these methods with Francesco Maggi, which led us to the solution of an old question left open by Brézis and Lieb about optimal trace Sobolev inequalities. These tools play a key role in the spectacular results thereafter obtained by Maggi and collaborators on the stability of isoperimetric inequalities.

• a synthetic definition of Ricci curvature lower bounds in measured metric spaces, the proof of stability of this definition, and its use to generalize to this setting various theorems of Riemannian geometry, thereby solving some open problems formulated by Gromov (works in collaboration with John Lott; closely related results have been independently obtained by Karl-Theodor Sturm).

• the proof of existence of equilibrium distributions with abnormally thick tails, for a model of diffusive inelastic hard spheres, as conjectured by the physicist Matthieu Ernst (work in collaboration with Irene Gamba and Vladislav Panferov).

• the discovery of a new geometric property of the tangent cut locus in Riemannian geometry: if the Ma–Trudinger–Wang curvature tensor is strictly positive, and in the absence of focalization, this cut locus is the boundary of a convex region. An outcome of this work was the proof that an almost round metric on the n-dimensional sphere has uniformly convex injectivity domains. This is part of a series of works by Alessio Figalli, Grégoire Loeper, Ludovic Rifford and myself.

• the first mathematical treatment of Landau damping in the nonlinear régime (with Clément Mouhot).

Books

- **A Review of Mathematical Topics in Collisional Kinetic Theory** (230 pages): This is a review article with the size and structure of a book, about kinetic models for collisions, such as the Boltzmann equation and its variants. It appeared in 2002 in the *Handbook of Mathematical Fluid Dynamics, Vol. I*, edited by Susan Friedlander and Denis Serre, published by North-Holland.

- **Topics in Optimal Transportation** (360 pages): This book deals with the Monge-Kantorovich minimization problem and its applications. It was published in 2003 by the American Mathematical Society in the *Graduate Studies in Mathematics* series, vol. 58.

- **Optimal transport, old and new** (1000 pages): Grown from a series of lectures at the 2005 Saint-Flour probability summer school, this ambitious book is a complement to my previous book on optimal transport, presenting alternative proofs, a more synthetic point of view, sharper and more general statements (many of them specifically proven for this course). Apart from a probabilistic point of view, I develop at length the recently discovered links between optimal transport and dynamical systems on the one hand (Mather problem), and differential geometry on the other hand (Ricci curvature). Volume 338 of the collection *Grundlehren der mathematischen Wissenschaften* published by Springer-Verlag.

All these books present recent research results while striving to be readable by nonspecialists.

- I have also been working for the past few years on an elementary textbook on integration theory and Fourier analysis, based on my lecturing experience (expected 400 pages).

Conference organization

Together with Gérard Besson, Yann Ollivier and Ghani Zeghib, I organized the conference *Glimpses of Geometry*, held in Lyon in May 2008; this event was part of a thematic trimester of Centre Émile Borel at Institut Henri Poincaré, about Ricci curvature and Ricci flow, and was aimed at presenting to participants images of contemporary research in geometry, insisting on the role of curvature. (Lecturers: M. Boileau, D. Burago, P. Chrusciel, G. David, M. Gromov, F. Maggi, L. Ni, K.-Th. Sturm, A. Thalmaier, C. Viterbo, S. Wenger)

Together with Yann Ollivier and Hervé Pajot, I was co-organizer of a summer school on optimal transport in Grenoble in June-July 2009.

TRAINING AND EVALUATION

Research training: PhD advising

- Clément Mouhot: *Quelques propriétés qualitatives des équations cinétiques collisionnelles*. Clément defended in November 2004, entered CNRS in September 2005.
- François Bolley: *Application du transport optimal à des problèmes de limites de champ moyen*. François defended in December 2005 and was hired as an assistant professor in Paris-Dauphine in September 2006; now reader in Cambridge.
- Alessio Figalli (joint supervision with Luigi Ambrosio, and partial training by Albert Fathi): *Optimal transportation and action-minimizing measures*. Alessio defended in October 2007, just after entering CNRS. Professor Hadamard in the École Polytechnique, then professor at the University of Texas at Austin.
- Rémi Peyre: *Quelques problèmes d'inspiration physique en théorie des proba bilités*. Rémi defended in November 2010, now assistant professor in Nancy.

I am currently supervising the PhDs of Thomas Gallouët (joint supervision with Ludovic Rifford) and Max Fathi.

Participation in jurys

PhD jurys (by chronological order): Dario Cordero-Erausquin, Olivier Druet, Hélène Guérin, Ivan Gentil (referee), Florent Malrieu (president), Kévin Guittet (referee), Grégoire Loeper (referee), Maxime Hauray (referee), Mylène Maïda, Nathaël Gozlan, Mohammed Sbihi, Marc Bernot (referee), Gaël Benabou (president), Jérôme Demange (referee), Jinghai Shao (referee), Aline Kurtzmann, Vincent Calvez (president), Nicola Gigli (referee).

Jury of habilitation [for PhD advising]: Pierre-Emmanuel Jabin (referee), Frédéric Hérau (referee), Filippo Santambrogio (referee), Olivier Druet.

Evaluation of research papers

I was referee for more than 100 research papers in international journals, and (serious!) reviewer for more than 60 papers in the *MathSciNet* database.

Scientific committes

I have worked as an expert for the organization of the following international conferences:
- Hyperbolic Equations (Lyon, July 2006)
- Particle systems, nonlinear diffusions and equilibration (Bonn, November 2007)
- Glimpses of geometry (Lyon, May 2008; for this conference I also belonged to the local organizing committee)
- Conference on Function Spaces, differential operators and nonlinear analysis (Helsinki, August 2008)
- Conference in the memory of Carlo Cercignani (IHP, February 2011)

I belonged for several years in the Programmation Committees for the Institut Henri Poincaré, the États de la Recherche of the French Mathematical Society, the FRUMAM in Marseille, and several CNRS Research projects (CHANT, AEDP)

TEACHING EXPERIENCE

At undergraduate level

Since September 2000 I have taught courses in probability, analysis, partial differential equations, information theory and statistics to the students of ENS Lyon, then University of Lyon. Some lecture notes are available on my Web page.

At graduate level

- Méthode de Newton (University of Lyon, 2011)
- Équation de Vlasov (University of Lyon, 2010)
- Transport optimal (ENS Lyon, 2006)
- Limite de champ moyen en physique statistique (ENS Lyon, 2001-2002)
- The Monge-Kantorovich minimization problem (Georgia Tech, Atlanta, 1999)
- Équations de Vlasov (Univ Lyon 2011), Newton method and developments (Lyon, 2012)

Invited graduate or research-level courses

- Landau damping (short course, Cotonou, Benin, June 2010; CIRM, Luminy, July 2010)
- Geometrical aspects of optimal transport (short course, Ischia, June 2010)
- Transport optimal et géométrie (short course, Rennes, April 2010)
- Curvature and regularity of optimal transport (short course, IAS, February 2009)
- Optimal transport and geometry (short course, "Probabilistic approach to geometry", Kyoto, June 2008)
- **CIME** course (Cetraro, June 2008)
- **Gergen Lectures** (Duke University, May 2008)
- Borel seminar (Leysin, summer school, September 2006)
- Hypocoercivity: The return (Trieste, workshop, June 2006)
- Hypocoercivity (Porto Ercole, summer school, June 2006)
- New trends in optimal transport (Bonn, February 2006)
- Optimal transport and geometry (MSRI, November 2005, cancelled for medical reasons)
- Optimal transport, old and new (**Saint-Flour** probability summer school, July 2005)
- Transport optimal (short course, Orléans, May 2005)
- Optimal transport (Dortmund, March 2005)
- Mathematics of granular media (Institute Henri Poincaré, February 2005)
- Propriétés qualitatives des solutions de l'équation de Boltzmann (**Cours Peccot** of the Collège de France, May-June 2003)
- Optimal transport and applications (**Oberwolfach seminars**, October 2002; I co-organized this thematic week with Luigi Ambrosio from Pisa).
- Entropy production and convergence to equilibrium (Institute H. Poincaré, 2001)
- Mass transportation tools for dissipative PDE's (International **CIME** Summer School, Martina Franca, September 2001)
- On the spatially homogeneous Boltzmann equation (Crete conferences in mathematics, Anogia, June 2001; in association with Stéphane Mischler et Bernt Wennberg)
- Quelques aspects de l'équation de Boltzmann (Rennes, June 2001)
- Mass transportation: the geometry of diffusive equations (Ponta Delgada, Açores, September 2000, in association with Robert McCann et Felix Otto).

PUBLICATION LISTS

Research papers (published or accepted for publication)

[1] With P.-L. Lions: Régularité optimale de racines carrées, *C.R. Acad. Sci. 321* (1995), 1537–1541.

[2] On the Landau equation: weak stability, global existence. *Adv. Diff. Eq. 1*, 5 (1996), 793–816.

[3] On the spatially homogeneous Landau equation for Maxwellian molecules. *Math. Meth. Mod. Appl. Sci. 8*, 6 (1998), 957–983.

[4] On a new class of weak solutions to the spatially homogeneous Boltzmann and Landau equations. *Arch. Rat. Mech. Anal. 143*, 3 (1998), 273–307.

[5] Fisher information estimates for Boltzmann's collision operator. *J. Maths Pures Appl. 77* (1998), 821–837.

[6] Conservative forms of Boltzmann's collision operator: Landau revisited. *Math. Mod. An. Num. 33*, 1 (1999), 209–227.

[7] With G. Toscani: Probability metrics and uniqueness of the solution to the Boltzmann equation for a Maxwell gas. *J. Stat. Phys. 94*, 3/4 (1999), 619–637.

[8] With G. Toscani: Sharp entropy dissipation bounds and explicit rate of trend to equilibrium for the spatially homogeneous Boltzmann equation. *Comm. Math. Phys. 203*, 3 (1999), 667–706.

[9] Regularity estimates via the entropy dissipation for the spatially homogeneous Boltzmann equation without cut-off. *Rev. Matem. Iberoam. 15*, 2 (1999), 335–352.

[10] With L. Desvillettes: On the spatially homogeneous Landau equation for hard potentials. Part I: existence, uniqueness and smoothness. *Comm. P.D.E 25*, 1–2 (2000), 179–259.

[11] With L. Desvillettes: On the spatially homogeneous Landau equation for hard potentials. Part II: H-Theorem and applications. *Comm. P.D.E 25*, 1–2 (2000), 261–298.

[12] Decrease of the Fisher information for solutions of the spatially homogeneous Landau equation with Maxwellian molecules. *Math. Mod. Meth. Appl. Sci. 10*, 2 (2000), 153–161.

[13] With G. Toscani: On the trend to equilibrium for some dissipative systems with slowly increasing a priori bounds. *J. Statist. Phys. 98*, 5–6 (2000), 1279–1309.

[14] With F. Otto: Generalization of an inequality by Talagrand, viewed as a consequence of the logarithmic Sobolev inequality. *J. Funct. Anal. 173*, 2 (2000), 361–400.

[15] With R. Alexandre, L. Desvillettes and B. Wennberg: Entropy dissipation and long-range interactions. *Arch. Rat. Mech. Anal. 152* (2000), 327–355.

[16] A short proof of the "concavity of entropy power". *IEEE Trans. Info. Theory 46*, 4 (2000), 1695–1696.

[17] With L. Desvillettes: On the trend to global equilibrium in spatially inhomogeneous systems. Part I: the linear Fokker–Planck equation. *Comm. Pure Appl. Math. 54*, 1 (2001), 1–42.

[18] With F. Otto: Comment on: "Hypercontractivity of Hamilton-Jacobi equations", by S. Bobkov, I. Gentil and M. Ledoux. *J. Math. Pures Appl. (9) 80*, 7 (2001), 697–700.

[19] With R. Alexandre: On the Boltzmann equation for long-range interactions. *Comm. Pure Appl. Math. 55*, 1 (2002), 30–70.

[20] With E. Caglioti: Homogeneous cooling states are not always good approximations to granular flows. *Arch. Rational Mech. Anal. 163*, 4 (2002), 329–343.

[21] With L. Desvillettes: On a variant of Korn's inequality arising in statistical mechanics. *ESAIM Control Optim. Calc. Var. 8* (2002), 603–619.

[22] With L. Pareschi and G. Toscani: Spectral methods for the non cut-off Boltzmann equation and numerical grazing collision limit. *Numer. Mat. 93* (2003), 527–548.

[23] Cercignani's conjecture is sometimes true and always almost true. *Commun. Math. Phys. 234* (2003), 455–490.

[24] With J.A. Carrillo and R. McCann: Kinetic equilibration rates for granular media and related equations: Entropy dissipation and mass transportation estimates. *Revista Matemática Iberoamericana 19* (2003), 1–48.

[25] With D. Cordero-Erausquin and B. Nazaret: A new approach to sharp Sobolev and Gagliardo–Nirenberg inequalities. *Adv. Math. 182* (2004), 307–332.

[26] With R. Alexandre: On the Landau approximation in plasma physics. *Ann. Inst. H. Poincaré Anal. Non Linéaire 21*, 1 (2004), 61–95.

[27] With I. Gamba and V. Panferov: On the Boltzmann equation for diffusively excited granular media. *Comm. Math. Phys. 246*, 3 (2004), 503–541.

[28] With C. Mouhot: Regularity theory for the spatially homogeneous Boltzmann equation with cut-off. *Arch. Rational Mech. Anal. 173*, 2 (2004), 169–212.

[29] With L. Desvillettes: On the trend to global equilibrium for spatially inhomogeneous kinetic systems: the Boltzmann equation. *Invent. Math. 159* (2005), 245–316.

[30] With F. Maggi: Balls have the worst best Sobolev inequalities. *J. Geom. Anal. 15*, 1 (2005), 83–121.

[31] With F. Bolley: Weighted Csiszár–Kullback–Pinsker inequalities and applications to transportation inequalities. *Ann. Fac. Sci. Toulouse Math. 14*, 3 (2005), 331–352.

[32] With J.A. Carrillo and R. McCann: Contractions in the 2-Wasserstein length space and thermalization of granular media. *Arch. Rational Mech. Anal. 179* (2006), 217–263.

[33] With F. Bolley and A. Guillin: Quantitative concentration inequalities for empirical measures on non-compact spaces. *Probab. Theory Related Fields 137*, 3-4 (2007), 287–314.

[34] With J. Lott: Weak curvature bounds and functional inequalities. *J. Funct. Anal. 245*, 1 (2007), 311–333.

[35] With J. Lott: The Hamilton–Jacobi semigroup on length spaces and applications. *J. Math. Pures Appl. 88*, 3 (2007), 219–229.

[36] With A. Figalli: Strong displacement convexity on Riemannian manifolds. *Math. Z. 257*, 2 (2007), 251–259.

[37] With F. Maggi: Balls have the worst best Sobolev inequalities, II. Variants and extensions. *Calc. Var. Partial Differential Equations 31*, 1 (2008), 47–74.

[38] Weak stability of a fourth-order curvature condition arising in optimal transport theory (30 pages). *J. Funct. Anal. 255*, 9 (2008), 2683–2708.

[39] With A. Figalli: An approximation lemma about the cut locus, with applications to optimal transport theory. *Meth. Appl. Anal. 15*, 2 (2008), 149–154.

[40] With L. Ni, J.-L. Vázquez and P. Lu: Local Aronson–Bénilan estimates and entropy formulae for porous medium and fast diffusion equations on manifolds. *J. Math. Pures Appl. 91*, 1 (2009), 1–19.

[41] With J. Lott: Ricci curvature for metric-measure spaces via optimal transport *Annals of Math. 169*, 3 (2009), 903–991.

[42] With N. Grunewald, F. Otto et M. Reznikoff: A two-scale approach to logarithmic Sobolev inequalities and the hydrodynamic limit *Ann. Inst. H. Poincaré Probab. Stat. 45*, 2 (2009), 302–351.

[43] Hypocoercivity. *Mem. Amer. Math. Soc. 202* (2009), no. 950

[**44**] With I. Gamba et V. Panferov: Upper Maxwellian bounds for the spatially homogeneous Boltzmann equation. *Arch. Ration. Mech. Anal. 194* (2009), 1, 253–282.

[**45**] With G. Loeper: Regularity of optimal transport in curved geometry: the nonfocal case. *Duke Math. J. 151* (2010), 431–485.

[**46**] With E. Carlen, M.C. Carvalho, J. Le Roux et M. Loss: Entropy and chaos in the Kac model. *Kinet. Relat. Models 3*, 1 (2010), 85–122.

[**47**] With A. Figalli et L. Rifford: On the Ma–Trudinger–Wang curvature on surfaces. *Calc. Var. Partial Differential Equations 39*, 3-4 (2010), 307–332.

[**48**] With A. Figalli, L. Rifford: On tangent cut loci of surfaces *Differential Geom. Appl. 29*, 2 (2011), 154-159.

[**49** With A. Figalli, L. Rifford: Necessary and sufficient conditions for continuity of optimal transport maps on Riemannian manifolds. *Tohoku. Math. J. 63*, 4 (2011), 855–876.

[**50**] With C. Mouhot: On Landau damping. *Acta Mathematica 207*, 1 (2011), 29–201.

[**51**] With A. Figalli, L. Rifford: Nearly round spheres look convex *Amer. J. Math. 134*, 1 (2012), 109-139.

Preprints

With Y. Ollivier: A curved Brunn–Minkowski inequality on the discrete cube – or: What is the Ricci curvature of the discrete hypercube? To appear in *SIAM J. on Discrete Math.*

Books and synthesis works

[**1**] A review of mathematical topics in collisional kinetic theory. In *Handbook of Mathematical Fluid Dynamics I*, 71–305, S. Friedlander et D. Serre, Eds, North-Holland, Amsterdam, 2002.

[**2**] Limites hydrodynamiques de l'équation de Boltzmann (d'après C. Bardos, F. Golse, C. D. Levermore, P.-L. Lions, N. Masmoudi, L. Saint-Raymond). Bourbaki Seminar, Exp. 893 (June 2001). *Astérisque 282* (2002), 365–380.

[**3**] Topics in Optimal Transportation. *Graduate Studies in Mathematics 58*, American Mathematical Society, Providence (2003).

[**4**] Optimal transportation, dissipative PDE's and functional inequalities. Notes for the CIME Summer School "Optimal transportation and applications" (Martina Franca, September 2002). *Lecture Notes in Math.*, vol. **1813**, L. Caffarelli et S. Salsa, Ed., Springer, 2003.

[**5**] Convergence to equilibrium: Entropy production and hypocoercivity. Text of my "Harold Grad lecture" in the 24^{th} Rarefied Gas Dynamics conference (Bari, 2004). *AIP Conference Proceedings vol. 762*, M. Capitelli, Ed., 8–25.

[**6**] Entropy production and convergence to equilibrium. Notes for a series of lectures in Institut Henri Poincaré, Paris (Fall 2001). In *Entropy methods for the Boltzmann equation, Lecture Notes in Math.,* vol. **1916**, F. Golse and S. Olla, Eds., Springer, 2008, pp. 1–70.

[**7**] Mathematics of granular materials. *J. Stat. Phys. 124* (2006), no. 2-4, 781–822.

[**8**] Hypocoercive diffusion operators. Text of my contribution to the International Congress of Mathematicians (Madrid, August 2006).

[**9**] Optimal transport, old and new. *Grundlehren der mathematischen Wissenschaften*, Vol. 338, Springer, 2009.

[**10**] Hypocoercivity. *Mem. Amer. Math. Soc. 202* (2009), no. 950.

[**11**] Paradoxe de Scheffer–Shnirelman revu sous l'angle de l'intégration convexe, d'après C. De Lellis et L. Székelyhidi. Bourbaki Seminar (November 2008).

[12] Regularity of optimal transport and cut locus: from nonsmooth analysis to geometry to smooth analysis. Review article (2010).

[12] Transport optimal. *Leçons de Mathématiques d'Aujourd'hui, Vol.4* (2011). Lecture given in Bordeaux in 2005 for an audience of graduate students; edited in 2008.

[13] Regularity of optimal transport and cut locus: from nonsmooth analysis to geometry to smooth analysis. *DCDS-A 30*, no.2 (dedicated to Louis Nirenberg). Review paper on the links between regularity of optimal transport and the geometry of cut locus (2010).

[14] Landau damping. Lecture Notes from a course taught in Cotonou (Benin), and CIRM in Luminy (Summer 2010). Updated in 2012.

[15] (Ir)réversibilité et entropie / (Ir)reversibility and entropy. Séminaire Poincaré (Bourbaphy) XV (Le Temps, 2010).

Conference proceedings and short surveys

[1] With P. Markowich: On the trend to equilibrium for the Fokker–Planck equation: an interplay between physics and functional analysis. *Mat. Contemp. 19* (2000), 1–29.

[2] With L. Desvillettes: Entropic methods for the study of the long time behavior of kinetic equations. International Conference on Transport Theory, Part I (Atlanta, GA, 1999). *Transport Theory Statist. Phys. 30*, 2–3 (2001), 155–168.

[3] On the trend to equilibrium for kinetic equations. Inhomogeneous random systems (Cergy-Pontoise, 2001). *Markov Process. Related Fields 8*, 2 (2002), 237–250.

[4] With I. Gamba and V. Panferov: On the inelastic Boltzmann equation with diffusive forcing, in *Nonlinear problems in mathematical physics and related topics II, in honor of Professor O.A. Ladyzhenskaya*, Int. Math. Ser. 2, New York (2002), 179–192.

[5] With A. Arnold, J.A. Carrillo, L. Desvillettes, J. Dolbeault, A. Jüngel, C. Lederman, P.A. Markowich and G. Toscani: Entropies and equilibria of many-particle systems: an essay on recent research. *Monatsh. Math. 142*, 1-2 (2004), 35–43.

[6] Trend to equilibrium for dissipative equations, functional inequalities and mass transportation. Notes for Summer School "Mass transportation methods in kinetic theory and hydrodynamics" (Ponta Delgada, Açores, 2000), in *Recent Advances in the Theory and Applications of Mass Transport*, M.C. Carvalho and J.F. Rodrigues, Eds, *Contemporary Mathematics*, vol. **353**, *Amer. Math. Soc., Providence, RI* (2004), 95–109.

[7] Entropy production and convergence to equilibrium for the Boltzmann equation. Notes for the 14^{th} International Congress of Mathematical Physics (Lisbon, 2003)

[8] Current trends in optimal transport – A tribute to Ed Nelson. Text of my lecture for the Conference in the honor of Edward Nelsons' seventieth birthday (Vancouver, juin 2004). Appeared in *Diffusion, quantum theory, and radically elementary mathematics*, Math. Notes, 47, Princeton Univ. Press, Princeton, NJ, 2006, pp. 141-156.

[9] Transport optimal et courbure de Ricci. *Sémin. Théor. Spectr. Géom. 24*, Année 2005–2006 (2007), 79–100.

[10] *H*-Theorem and beyond: Boltzmann's entropy in today's mathematics. Proceedings of the Boltzmann memorial conferences in Vienna and Munich (July & October 2006). In *Boltzmann's legacy, ESI Lect. Math. Phys., Eur. Math. Soc., Zürich*, 2008, pp.129-143.

[11] With A. Figalli: Optimal transport and curvature. Notes for my CIME course in Cetraro, June 2008.

[12] Local-to-global principles in Riemannian geometry and optimal transport. Oberwolfach Report, 2008.

[13] Landau damping. Oberwolfach Report, 2009.

[14] Optimal transport: Monge meets Riemann, and Fourier. Proceedings from a mathematical conference in Cairo, May 2010.

[15] With C. Mouhot: Landau damping. *J. Math. Phys. 51* (50th anniversary issue), 015204 (2010).

[16] Landau damping. Text of my contribution to the International Congress of Mathematicians (Hyderabad, August 2010).

Preface

I wrote the introduction of the special volume of *Journal of Statistical Physics* dedicated to Carlo Cercignani (*J. Stat. Phys. 124*, 2-4 (2006), 271–273).

Broad audience text

Transport optimal de mesure: Coup de neuf pour un très vieux problème. In the journal *Images des Mathématiques 2004*, edited by CNRS.

INVITATIONS AND COMMUNICATIONS

Invitations

- Brown University, Providence (July 2012)
- IHÉS, Bures-sur-Yvette (permanent part-time visitor since 2009)
- IAS, Princeton (January–June 2009)
- Kyoto University, one month (Summer 2008)
- Australian National University, Canberra, three months (Summer 2007)
- IAS, Princeton, two weeks (February 2007)
- University of Dortmund, one week (March 2005)
- University of California at Berkeley, four months (January-May 2004)
- University of Austin (Texas), two weeks (April 2003)
- Reading University (UK), three months (January-March 2003)
- Academia Sinica (Taipei, Taiwan), three weeks (January 2002)
- Cheng Kung University (Tainan, Taiwan), one week (January 2002)
- MIT (Boston), two weeks (April 2001)
- University of Austin (Texas), one month (November 2000)
- Georgia Tech (Atlanta), five months (fall 1999)
- University of Pavia, two months (March-April 1999)
- UCSB (Santa Barbara), two weeks (February 1999)
- Courant Institute (New York), one week (February 1999)
- Georgia Tech (Atlanta), one week (November 1998)
- Erwin Schrödinger Institute (Vienna), one week (October 1998)
- University of Pavia, two weeks (October 1997)

Invited lectures

French-Romanian Meeting (Bucharest, August 2012)

Magna Lectures (Rio and Sao Paulo, Brazil, August 2012)

South-American Conference, CLAM IV (Cordobà, August 2012)

Conference on Fluid Mechanics (Dublin, July 2012)

Annual meeting of the American Physics Society, Division of Plasma Physics (Salt Lake City, November 2011)

5th International Conference on Research and Education in Mathematics (Bandung, October 2011)

30th anniversary of the CIRM (Luminy, October 2011)

Conference in the honor of Srinisava Varadhan (Taipei, July 2011)

London Mathematical Society Meeting (London, July 2011)

Congress of the French Society of Physics (Bordeaux, July 2011)

Conference for the 20th anniversary of Institut Universitaire de France (Lyon, June 2011)

Teratec Conference on High Speed Computing (Paris, June 2011)

Conference in the honor of Henri Berestycki (Paris, June 2011)

Inauguration of the Fondation Jacques Hadamard (Orsay, May 2011)

CIMPA Conference in Senegal (Dakar, April 2011)

Inauguration of the conference of the centennial of the Spanish Mathematical Society (Avila, February 2011)

Conference of the Publications de l'IHÉS "Kaleidoscopic views of mathematics" (IHÉS, January 2011)

Conference in the memory of Paul Malliavin (Dijon, February 2011)

Abel Symposium 2010 (Oslo, October 2010)

Inauguration conference for the Tullio Levi-Civita Center (Rome, September 2010)

Conference in the honor of Lello Esposito (Rome, September 2010)
International Congress of Mathematicians (Hyderabad, August 2010)
Workshop on Wave turbulence (Treilles, July 2010)
Conference in the honor of Stephanos Venakides (Paris, June 2010)
INdAM day (Catania, June 2010)
Conference "Emerging Topics in Dynamical Systems and Partial Differential Equations" (Barcelona, May 2010)
Egypt–France Mathematics Conference (Cairo, May 2010)
Conference in the honor of Michelle Schatzman (Lyon, December 2009)
Workshop on concentration, functional inequalities & isoperimetry (Boca Raton, November 2009)
Workshop on Partial Differential Equations (Oberwolfach, August 2009)
International Congress of Mathematical Physics (Prague, August 2009)
Workshop on kinetic theory and statistical mechanics (Lisbon, July 2009)
101th Statistical Mechanics Meeting (Rutgers, May 2009)
Columbia–Princeton Probability Day (New York, May 2009)
Fabes–Rivière Symposium (Minneapolis, April 2009)
Workshop on geometric analysis (IAS, February 2009)
South California Geometric Analysis Seminar (San Diego, February 2009)
European Congress of Mathematicians (Amsterdam, July 2008)
Workshop on Calculus of Variations (Oberwolfach, July 2008)
Workshop at the Institute Henri Poincaré (Ricci curvature program, June 2008)
50 Years Anniversary Conference of the IHES (May 2008)
Conference in the honor of Walter Strauss (Providence, May 2008)
Workshop "Geometric analysis" (Grenoble, March 2008)
Boltzmann Workshop (IHP, October 2007)
Australian–Chinese conference (Coolangatta, June 2007)
Plenary lecturer, 10th **Rencontres du Non Linéaire** (Paris, March 2007; mainly physicists)
Workshop on kinetic theory in Oberwolfach (December 2006)
International Congress of Mathematicians (Madrid, August 2006)
Conference on nonlinear partial differential equations, Xining (China, August 2006)
Plenary lecturer at the **French-Italian mathematical conference** in Torino (July 2006)
Boltzmann Symposium (Vienna, June 2006, and Munich, October 2006)
[in commemoration, hundredth anniversary of Ludwig Boltzmann's death]
Plenary lecturer, **Stochastic Processes and Applications** (Paris, July 2006)
Meeting in Oberwolfach around functional inequalities (November 2005)
Joint European–Catalan Mathematical Societies Conference (Barcelone, September 2005)
Meeting in Oberwolfach on hydrodynamical limits (May 2005)
Meeting in Luminy around random flows (April 2005)
Plenary lecturer in the **Franco–Nordic Meeting** (Reykjavik, January 2005)
Conference "Fluid and Plasma Dynamics" (MAFPD, Kyoto, September 2004)
Plenary lecturer, 10th **International Congress of Hyperbolic Problems** (Osaka, Sept. 2004)
Conference in the honor of Carlo Cercignani (Montecatini, September 2004)
Harold Grad lecture of the 24th "Rarefied Gas Dynamics" conference (Bari, July 2004)
Conference in the honor of Edward Nelson (UBC, Vancouver, June 2004)
Plenary lecturer in the **Congrès d'Analyse Numérique** (CANUM) 2004 (June 2004)
"Kinetic Equations", Oberwolfach (November 2003)
French–Tunisian Conference "Analysis and Probability" (Hammamet, October 2003)
"Partial Differential Equations", Oberwolfach meeting (August 2003)
Plenary lecturer, **International Congress of Mathematical Physics** (Lisbon, July 2003)
Kinetic equations, Hypoellipticity and Witten-Laplacian (Rennes, February 2003)
Workshop on logarithmic Sobolev inequalities (Versailles, December 2002)

"Recent advances on calculus of variations and PDE's" (Pisa, November 2002)
Conference in the memory of Jacques-Louis Lions (Paris, July 2002)
Colloquium of the CMLA (Ecole Normale Supérieure de Cachan, May 2002)
"Nonlinear models and analysis", (Schrödinger Institute, Vienna, June 2002)
"Logarithmic Sobolev inequalities in PDE's and probabilities" (Orléans, March 2002)
"Workshop on nonlinear analysis" (Academia Sinica, Taipei)
"Hydrodynamical limits", conference in the honor of Claude Bardos (IHP, Paris, October 2001)
"Optimal transportation and applications", CIME Summer School (Martina Franca, Aug. 2001)
"Problems and perspectives on calculus of variations" (Toronto, August 2001)
"Kinetic theory", "Crete Conferences" Summer school (Anogia, June 2001)
Rencontres mathématiques de l'ENS Lyon (Lyon, March 2001)
Workshop "Nonhomogeneous Random Systems" (Cergy, January 2001)
Workshop on Mass Transportation (Pisa, October 2000)
Summer school "Mass transportation methods in kinetic theory and hydrodynamics" (Ponta Delgada, Azores, September 2000).
Conference "New applications of kinetic theory" (Göteborg, June 2000)
"Nonlinear Analysis, 2000 and beyond", (Courant Institute, New York, May 2000)
Workshop on "Coulomb interactions, kinetic equations and asymptotic analysis" (Marseille, February 2000)
"Nonlinear equations in many-particles systems"(Oberwolfach, December 1999)
Specialized session of an AMS conference (Austin, October 1999)
"Isoperimetric inequalities and measure transportation" (Marseille, Sept. 1999)
European workshop on kinetic theory (Santa Margherita Ligure, April 1999)
Workshop devoted to the Landau equation (Paris, March 1999)
Workshop on kinetic theory (Ecole Normale Supérieure de Cachan, November 1998)
European workshop on kinetic theory (Vienna, October 1998)
Workshop on optimal transportation (Foljuif, June 1998)

Research Seminars

Brown University, LaSalle lectures (16/VII/12, 27/VII/12)
Berkeley University, Bowen lectures (29/II/12 - 02/III/12)
University of San Diego, colloquium (01/III/12)
École Normale Supérieure, Seminar for students (4/I/12)
École Centrale de Lyon, Seminar (23/III/11)
Ben Gurion University (Beer Sheva), Moshe Flato Lecture (10/III/11)
Weizmann Institute, Pekeris Lecture (8/III/11)
University of Budapest, stochastic analysis seminar (24/II/11)
Séminaire Poincaré (4/XII/10)
Collège de France, applied mathematics seminar (19/XI/10)
Institut Newton, kinetic theory program (16/XI/10)
Fields Institute, "Distinguished Lecture Series" (1–5/X/10)
Institut de Mathématiques de Jussieu, colloquium (20/V/10)
University of Paris-Sud, Orsay, Harmonic Analysis seminar (15/III/10)
Statistical Mechanics day, IHP (18/I/10)
Godeaux Lecture, Louvain-la-Neuve (4/XII/09)
University of Paris-Sud, Orsay, PDE seminar (3/XII/09)
École Polytechnique, X-EDP seminar (17/XI/09)
University of Lyon, Colloquium (9/XI/09)
Brown University, Providence, PDE seminar (2/XI/09)
University of Michigan, Ziwet lecture (27-29/X/09)
MIT, PDE seminar (20/X/09)
Harvard University, colloquium (19/X/09)
Toulouse University, lectures on evolution equations in plasma physics (ANR EVOL, 25/IX/09)
Colloquium of the Berlin Graduate School (Albert-Einstein Institute, Golm, 10/VII/09)
Colloquium of the Women and Mathematics Program (IAS, 17/VI/09)
Princeton Plasma Physics Laboratory (3/VI/09)
CUNY, graduate seminar (5/V/09)
Courant Institute, PDE seminar (2/IV/09)
Princeton University, analysis/Colloquium/mathematical physics seminars (24-25-30/III/09)
Rutgers, PDE seminar (18/II/09)
Rutgers University, Mathematical Physics seminar (29/I/09)
Bourbaki seminar (16/XI/08)
Joint seminar Paris 13 / Berkeley / Bonn / Zürich (9/X/08)
ENS Ulm, seminar Des Mathématiques (8/X/08)
University of Paris 6, PDE seminar (3/X/08)
University of Paris 5, Probability Colloquium (3/X/08)
Toulouse, joint PDE/probability seminar (30/IX/08)
EPFL Lausanne, PDE seminar (26/IX/08)
EPFL Lausanne, Colloquium (25/IX/08)
ETH Zürich, Physics Colloquium (24/IX/08)
ETH Zürich, PDE seminar (23/IX/08)
Sapporo University, PDE seminar (22/VII/08)
Kyoto University (Engineering), seminar (17/VII/08)
Oxford University, Stochastic analysis seminar (14/I/08)
Imperial College, London (11/I/08, 17/I/08)
Warwick University, PDE seminar (10/I/08)
Thematic day organized by Société Mathématique de France (30/XI/07)
University of Nantes, Colloquium (29/XI/07)

Scuola Normale di Pisa, Colloquium (24/X/07)
University of Brisbane, Colloquium (10/VIII/07)
University of Canberra (ANU), PDE seminar (18/VI/07) and Colloquium (28/VI/07)
University of Neuchâtel, Colloquium (22/V/07)
École Polytechnique, Colloquium (3/IV/07)
University of Évry, PDE seminar (15/III/07)
Indiana University (Bloomington), Colloquium (19/II/07)
IAS (Princeton), analysis seminar (16/II/07)
Rutgers University, mathematical physics seminar (15/II/07)
Princeton University, Colloquium (14/II/07)
ENS (Paris), "Des Mathématiques" seminar (17/I/07)
Max-Planck Institute de Leipzig, Colloquium (8/XII/06)
Joint IHES–Orsay PDE seminar (24/X/06)
University of Orsay–Paris Sud, Harmonic Analysis thematic day (23/X/06)
PDE-probability theory day at Institut H. Poincaré, Paris (25/IX/06)
University of Montpellier, geometry seminar (27/I/06)
University of Montpellier, Colloquium (26/I/06)
École Polytechnique, X-EDP Seminar (13/XII/05)
ETH Zürich, Colloquium (21/VI/05)
University of Bordeaux, Leçon de Mathématiques d'Aujourd'hui (02/VI/05)
University of Grenoble (17-18/IV/05)
University of Amiens (29/X/04)
University of Toulouse, Colloquium (9/VI/04)
University of Toulouse, applied mathematics seminar (8/VI/04)
University of California at Davis, Colloquium (3/V/04)
University of California at Berkeley, probability seminar (21/IV/04)
Stanford University, Colloquium (1/IV/04)
Stanford University, applied mathematics seminar (13/II/04)
University of California at Berkeley, partial differential equations seminar (30/I/04)
"Biséminaire" mathematics-physics (jointly with J.-P. Eckmann, IHP, Paris, 2/XII/03)
ENS Lyon, physics seminar (17/XI/03)
University of Paris VI, applied mathematics seminar (6/VI/03)
ENS Lyon, "Hypathie" Probability Seminar (jointly with Eric Carlen, 16-17/V/03)
University of Texas at Austin, seminars on optimal transportation (8/IV/03, 10/IV/03)
Warwick University, applied mathematics seminar (13/II/03)
Oxford University, analysis seminar (27/I/03)
Reading University, applied mathematics seminar (24/I/03)
SNS Pisa, De Giorgi Colloquium (7/XI/02)
Saarebrück University, Colloquium (22/III/02)
Ecole Polytechnique, Colloquium (5/II/02)
Academia Sinica (Taipei), several seminars (9/I/02, 10/I/02, 24/I/02)
Cheng Kung University (Tainan), applied mathematics seminar (15/I/02)
Institut Joseph-Fourier, Grenoble, applied mathematics seminar (2/X/01)
Bourbaki Seminar (23/VI/01)
University Paul-Sabatier (Toulouse), probability seminar (18/V/01)
Max-Planck Institute (Leipzig), Oberseminar (5/XII/00)
University of Bordeaux, applied mathematics seminar (30/XI/00)
University of Austin, analysis seminar (15/XI/00)
University of Austin, applied mathematics seminar (8/XI/00)
University of Rennes, applied mathematics seminar (23/III/00)

University of Paris VI, applied mathematics seminar (17/III/00)
ENS Lyon, applied mathematics seminar (17/II/00)
University of Clermont-Ferrand, applied mathematics seminar (3/II/00)
Brown University (Providence), applied mathematics seminar (15/XI/99)
University of Toronto, applied mathematics seminar (8/XI/99)
Georgia Tech, colloquium of the dynamical systems research team (1/XI/99)
Georgia Tech, applied mathematics seminar (28/IX/99)
University Pierre et Marie Curie, analysis seminar (6/V/99)
Henri Poincaré Institute, applied mathematics seminar (7/V/99)
University of Ferrara, Colloquium (19/IV/99)
University of Pavia, analysis seminar (7/IV/99)
University of Orléans, applied mathematics seminar (18/III/99)
University of Orléans, analysis seminar (17/III/99)
University Paul-Sabatier (Toulouse), probability seminar (12/III/99)
UCSB (Santa Barbara), applied mathematics seminar (25/II/99)
Courant Institute, applied mathematics seminar (5/II/99)
Georgia Tech, Colloquium (12/XI/98)
Georgia Tech, analysis seminar (11/XI/98)
Ecole Normale Supérieure (Paris), applied mathematics seminar (16/XII/97)
University of Pavia, analysis seminar (10/X/97)

Broad-audience lectures for non-specialists

These are lectures of about one hour each, followed by a debate, for a scientific but non-specialist audience.

After the Fields Medal: Broad audience lectures at IHP, UPMC, Metz, Oslo, Montreal, Toronto, Shanghai, high schools: Montaigne (Bordeaux), Louis-le-Grand (Paris), Victor-Duruy (Paris), Henri Poincaré (Nancy), Ferrières (Montargis), Charles-de-Gaulle (Dijon), Renoir (Angers); Yverdon gymnasium, Collège Méditerranéen des Libertés, Futuroscope (Poitiers); Universities of Nice, Fribourg, Paris-VI, think-tanks with business schools students, business unions, McKinsey, Nelly-Rodi, french high schools, French Institutes (Bonn, Bucarest, Budapest, Dakar, etc.); mathematically developing countries (Palestine), etc. About 30 public lectures per year.

Before the Fields Medal:

"Vingt ans de mathématiques" (Broad audience lecture at Marathon des Sciences, Fleurance, 7/VIII/10)

"Entropie et Théorème H" (Lecture for new recruits of the École Polytechnique, 7/V/10)

"Les prodigieux théorèmes de Monsieur Nash" (Lecture cycle "Un texte, un mathématicien" at the Bibliothèque Nationale de France, 7/IV/10; and Fermat Prize ceremony, Toulouse, 10/V/10)

"Peut-on mathématiquement prédire l'avenir du système solaire? (Closing ceremony for a competition of the International Committee of Mathematical Games (CIJM), Fête de la Science, IHP, 22/XI/09)

"Le Billard Moléculaire de Ludwig Boltzmann" (cycle des Soirées Scientifiques de l'Université Claude Bernard - Lyon I, 11/X/05)

"Mathématiques du billard moléculaire" (Fête de la Science, Clermont-Ferrand, 14/X/04)

"Le mouvement brownien" (Public session of the Academy of Sciences at Lyon, 26/I/05)

"Deux histoires de particules" (lecture for the l'Association des Professeurs de Mathématiques de l'Enseignement Public [APMEP], 28/IX/02)

"Mouvement brownien" (broad-audience lecture at ENS Lyon, 20/III/02)

Round tables, speeches and public discussions

Ceremonies for prizes, diplomas, Parliamentary missions, gatherings by political parties, professional meetings; interviews for dozens of magazines in France and abroad. Radio, Television, series of chronicles, etc. Some of them can be found on the broad-audience section of my Web page.

Broad-audience writings

Prefaces, articles for magazines, chronicles in newspapers, written interviews. I am publishing a broad-audience book with the publisher Grasset (August 2012). Some of these writings, and extracts, are available on the broad-audience section of my Web page.

Other institutional activities

I serve as an administrator for several associations, in particular the pro-European Think-Tank EuropaNova.

I am President of the Scientific Board of the panafrican institute AIMS-Senegal