Prof. Cédric Villani
Professor

Most important awards, prizes and academies

He has received several national and international prizes for his research, in particular the Knight of the National Order of Merit (2009), the Legion of Honor (2011) and the Fields Medal, awarded at the 2010 International Congress of Mathematicians in Hyderabad (India), by the President of India. Since then he has served as a spokesperson for the French mathematical community in media and political circles. He belongs to the editorial boards of Inventiones Mathematicae, the Journal of Functional Analysis (JFA), the Journal of Mathematical Physics (JMP) and the *Journal of Statistical Physics (JSP). He also serves as an administrator for several associations, in particular the pro-European Think-Tank EuropaNova. He is President of the Scientific Board of the Panafrican Institute AIMS-Senegal.

Summary of scientific research

In 1998 he defended his PhD on the mathematical theory of the Boltzmann equation. Besides his advisor Pierre-Louis Lions (Paris, France), he was much influenced by Yann Brenier (Nice, France), Eric Carlen (Rutgers, USA) and Michel Ledoux (Toulouse, France).
From 2000 to 2010 he was professor at École Normale Supérieure de Lyon, and is currently at the Université de Lyon. He occupied visiting professor positions in Atlanta, Berkeley and Princeton. Since 2009 he has been the director of the Institut Henri Poincaré in Paris.

His main research interests are in kinetic theory (Boltzmann and Vlasov equations and their variants), and optimal transport and its applications. More generally, he is fond of subjects which combine several (if not all) of the following themes:

- Evolution partial differential equations
- Fluid mechanics
- Statistical mechanics
- Probability theory
- Smooth and nonsmooth “metric” Riemannian geometry
- Functional inequalities with geometric content.

Main publications

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 MongeKantorovich 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 his 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, he develops 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.

He has also been working for the past few years on an elementary textbook on integration theory and Fourier analysis, based on his lecturing experience (expected 400 pages).