

# Curriculum Vitae

## Pierre Degond

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### PERSONAL INFORMATION:

French citizen

### EDUCATION:

#### **Habilitation à Diriger des Recherches, Université Paris 6, 1989**

Certification for being a Full Professor in French Universities

*Dissertation:* Kinetic Theory of Charged Particle Fluids: Mathematical Analysis,  
Numerical Analysis and Implementation of Particle Methods

*Advisor:* Claude Bardos

#### **PhD, Université Paris 6, 1983**

*Dissertation:* Existence and Asymptotic Behavior of the Solutions of the Linearized  
Vlasov-Poisson Equations

*Advisor:* Claude Bardos

#### **Agrégation, 1981**

French national certification to be a high-school teacher

#### **Master (Maîtrise), Université Paris 6, 1980**

#### **Admission to the Ecole Normale Supérieure, rue d'Ulm, Paris, 1979**

One of the most prestigious French 'Grandes Ecoles'

### RESEARCH INTERESTS: (See also Research Summary on p. 41)

Modeling and simulations using kinetic equations and related models (particle models,  
fluid models) ; applications to gases, plasmas and semiconductors

Numerical methods for multiple scale problems ; Asymptotic-Preserving schemes

Collective dynamics and self-organization in biology and social sciences

## ACADEMIC EXPERIENCE:

**Chair Professor**, Imperial College, London, UK, Oct 2013 - date

**1/3 Teaching Appointment tied with a Scientific Excellence Premium awarded by CNRS**, Université Paul Sabatier, Toulouse, France, 2010-2013

**Senior Researcher (Directeur de Recherches)**, Centre National de la Recherche Scientifique (CNRS), Institut de Mathématiques de Toulouse, France, Sept. 1993 - Sept. 2013

**Full Professor:** Ecole Normale Supérieure de Cachan, France, Sept. 1990 - Aug. 1993

**Junior Researcher (Chargé de Recherches)**, Centre National de la Recherche Scientifique (CNRS), Centre de Mathématiques Appliquées, Ecole Polytechnique, Palaiseau, France, Sept. 1985 - Aug. 1990

## SECONDARY EMPLOYMENT:

**Scientific Consultant**, ONERA (French National Office for Aeronautics and Space Studies and Research), Toulouse, Feb. 2002 - Dec. 2006

**Scientific Consultant**, CEA (French Atomic Energy Commissioner), Limeil, France, Sept. 1988-Aug. 1995

**Part-time Assistant Professor (Maître de Conférences)**, Ecole Polytechnique, Palaiseau, Sept. 1988-Aug. 1990

## VISITING POSITIONS:

Tsinghua University, Beijing, China 05/2011

Visiting position funded by the Japan Society for the Promotion of Science (JSPS), Kyoto University, Japan, 11/2000

Institute of Advanced Study, Princeton, USA, 02-04/1995

Institute of Mathematics and Applications, University of Minnesota, Minneapolis, USA, 05/1987

## AWARDS:

Wolfson Research Merit Award of the Royal Society, 2013.

Jacques-Louis Lions Prize of the French Academy of Sciences, 2013.

Scientific Excellence Premium awarded by CNRS, 2010-2013

Promotion to the 'Exceptional Class' of CNRS Senior Researchers (Directeurs de Recherches): the last step in the CNRS career scale, 2010

Prize 'Charles-Louis de Saulces de Freycinet' of the french Academy of Sciences, 1995

Bronze medal, CNRS, 1988

## EDITORSHIPS:

Founding Managing Editor, *Kinetic and Related Models (KRM)*: (together with Tong Yang and Kazuo Aoki), AIMS, 2008-date

Editorial boards of

*Analysis and Applications*, 2012-date

*Journal of Statistical Physics*, 2007-date

*Communications in Mathematical Sciences*, 2004-date

*Journal of Computational Physics*, 2000-date

Book series *Modeling and simulation in science, engineering and technology* (Birkhauser): 1995-date

*Mathematical Models and Methods in Applied Sciences*: 1993-date

*ESAIM. Mathematical Modeling and Numerical Analysis*, 1995-2002

*Annales de la Faculté des Sciences de Toulouse*, 1995-2000

Book series *Mathématiques et Applications* under the patronage of SMAI: 1995-2000

## RESEARCH GRANTS:

Co-PI, CNRS Interdisciplinary Project “DEESSes: Dynamics and Emergence in economics and social sciences”, 2013-2014

Co-PI, grant funded by the regional government of the region ‘Midi-Pyrénées’: “Modeling tissue homeostasis and regeneration mechanisms”, 2013-2015

Member, NSF Research Network ‘KI-net: Kinetic Description of Emerging Challenges in Multiscale Problems’, 2012-2016

Coordinator and co-PI, grant funded by ANR (French National Research Agency) “MO-TIMO: Imaging and Modeling of Seminal Massal Motility for Automatized Fertility Assessments”, 2011-2015

Co-PI, Grant funded by Foundation RTRA-STAE (“Midi-Pyrénées”-Region Research foundation for Aeronautics and Space) “AGREMEL: Scale Aggregation for Mixing Processes”, 2011-2014.

Member, Grant funded by ANR “BOOST: Building the Future of Numerical Simulations for ITER”, 2011-2014

Member, Scientific Action of the University Paul Sabatier “DYNABANC: Experimental Study and Modeling of Fish Schools”, 2011-2013

Co-PI, CNRS Interdisciplinary Project “MATH: Modeling Adult Tissue Homeostasis”, 2012-2013

PI, Grant funded by the regional government of the “Région Midi-Pyrénées”, “Study of the tumor growth via the modeling of cell collective dynamics”, 2010-2013

Co-PI, CNRS Interdisciplinary Project ‘S2M: Sperm Mobility Modeling’, 2011-2012

Co-PI of the INRIA Large-Scale Initiative “FUSION: Modeling and Numerical Simulation for Magnetic Fusion”, 2009-2012

Scientific Board Member of the Collaborative Grant funded by ANR “CBDIF: Collective Behavior and Diffusion: Mathematical Models and Simulations”, 2009-2011

PI, Scientific Action of the University Paul Sabatier “MOSITER: Modelling and Simulation for ITER”, 2009-2011

Coordinator and co-PI, Grant funded by the ANR “PEDIGREE: Pedestrian Groups : Emergence of Collective Behavior”, 2009-2011

Co-PI, Grant funded by the ANR “PANURGE: Collective Displacements Among Gregarious Vertebrates”, 2008-2011

Co-PI, NSF Focused Research Grant “Kinetic Description of Multiscale Phenomena”, 2008-2011

Member, Grant funded by the ANR “QUATRIN: Quantum Transport in Nanostructures”, 2007-2010

Co-PI, Bilateral Action Galileo (funded by French Ministry of Foreign Affairs) with IAC-CNR (Roma) “New Mathematical Tools for Info-Mobility”, 2009-2010

Co-PI, Grant funded by Foundation RTRA-STAE “PLASMAX: Plasma-Microwave Interactions for Aerospace Applications”, 2008-2010

Co-PI, Bilateral Action Procope (funded by French Ministry of Foreign Affairs) with TU-Kaiserslautern “Modeling, Simulation and Optimization of Supply Chains through Partial Differential Equations”, 2007-2009

Training Committee Member, Marie-Curie European Grant “DEASE: Differential Equations in Applied Sciences and Engineering” 2006-2009

Member, GDR CNRS network “CHANT: Kinetic and Hyperbolic Equations”, 2005-2009

Member, Grant funded by the ANR “Numerical Methods for Kinetic Equations”, 2006-2008

Co-PI, Cooperative Grant ARC INRIA “Magnetized Plasmas”, 2006-2008

Coordinator and Co-PI, CNRS International Cooperation Program (PICS) with Japan “NANODYN: Kinetic and Hydrodynamic Models for Micro and Nano Fluid Dynamics”, 2005-2007

Scientific Board Member, GDR CNRS Network “GRIP: Particle Interactions”, 2002-2006

Responsible and PI of the Partnership between Institut de Mathématiques and CEA (French Atomic Energy Commissioner) “Laboratoire de Recherches Correspondant LRC M06”, 2002-2006

Coordinator and Co-PI, Network funded by the “Midi-Pyrénées” Regional Government with Barcelona and Bilbao, “Mathematical Modeling of Particle Interactions through PDE’s”, 2003-2005

Steering Committee Member, European Network (IHP Program) “HYKE: Hyperbolic and

Kinetic Equations”, 2002-2005

Co-PI, Bilateral Cooperation with Japan (funded by CNRS & JSPS) with Kyoto University “Micro-Scale Gas Flows”, 2002-2004

Co-PI, Bilateral Action Procope with TU-Mainz and WIAS-Berlin “Numerics on Hybrid Models for Quantum Semiconductors”, 2003

Co-PI, Bilateral Action Amadeus (funded by French Ministry of Foreign Affairs) with TU-Wien, 2002-2003

PI, INTAS Grant with Russian Academy of Sciences (Siberian Branch), 2002-2003

PI, CNRS-NSF Collaboration with Brown University and UT Austin, 1999-2002

PI, Franco-Chinese Collaboration LIAMA (funded by INRIA) with Chinese Academy of Sciences (Beijing): 1998-1999

PI, Bilateral Collaboration Program with Tunisia Funded by CMCU, 1996-1998

Co-PI, Bilateral Action Procope with TU-Berlin, 1996-1998

Co-PI, European Network (TMR Program) “Kinetic Theory”, 1998-2001

Member, European Network (HCM Program) “Nonlinear Spatio-Temporal Structures”, 1994-1997

PI, Collaborative Research Grant (funded by NATO) with Irkutsk Computing Center, 1996

PI, CNRS Research Grant ATP (Focused Research Program) Mathematics and Computer Science “Particle methods for hydrodynamics”, 1988-1989

## **INDUSTRIAL RESEARCH CONTRACTS:**

Co-PI, Contract with CEA (French Atomic Energy Commissioner) “STRADEMAG: Frozen-field Magneto-Hydrodynamics”, 2013

Co-PI, Contract with CEA (French Atomic Energy Commissioner) “HYPARCADIA: Hybrid Parallel Code for Ionospheric Diamagnetic Cavity Simulation”, 2012

Co-PI, Contract with CEA “COLLICADIA: Collisions in Ionospheric Diamagnetic Cavity”, 2011.

Co-PI, Contract with CEA “SINEVOCADI: Simulation of the Evolution of a Ionospheric Diamagnetic Cavity”, 2010

PI, Contract with CEA and Euratom “APPLA: Asymptotic-Preserving Schemes for Plasma Transport”, 2010

Co-PI, Contract with AREVA (French number one Nuclear Plant Building Company) “Smart Grids: Multiscale Methods for Transport on Power Networks”, 2010

PI, Contract with CEA “PICCADIA: PIC Methods for Ionospheric Diamagnetic Cavity Modeling”, 2009

PI, Contract with CEA and Euratom “Gyro-AP: Asymptotic-Preserving Schemes for

Plasma Turbulence Models in the Gyro-Fluid Limit', 2009

PI, Contract with CEA "ACADIA: Modeling a Ionospheric Diamagnetic Cavity", 2009

PI, Contract with ONERA (French National Office for Aeronautics and Space Studies and Research) "Coupling PIC methods with Maxwell equations", 2009

PI, Contract with CEA and Euratom "GYROSTAB: GYRO-Scale Uniformly Stable Schemes for Fluid Modeling of Plasma Turbulence", 2008

Co-PI, Contract with DGA (Weapons General Directorate) "PRACT-X: Prediction of Air Contaminant Transport on Multiple (X) Scales", 2008

PI, Contract with CEA "ELMAG: Electrical Effects in Frozen-Field Magnetohydrodynamics", 2008

PI, Contract with CEA "ASTRE: Asymptotically Stable Schemes for Scale Transition Problems", 2007-2008

PI, Contract with CEA "MAGNEFIG: Frozen-Field Magnetohydrodynamics for Ionospheric Plasma Simulations", 2007

PI, Contract with CEA "DYNAMO-3D: Dynamo Modeling of Ionospheric Irregularities", 2006

PI, Contract with CEA "MOINE: Flow-Microwave Interactions", 2004-2005

PI, Contract with CEA "Ionospheric Plasma Away from Equilibrium through Massless Magnetohydrodynamics", 2004

PI, Contract with CEA "Hybrid Kinetic-Fluid Models for Non-Equilibrium Plasmas" 2001-2004

PI, Contract with CNES (French National Space Center) "SCARP: Scenario for Electrical Breakdown of Satellite Solar Generators", 2001-2004

PI, Contract with CEA "Laser Propagation in a KDP Crystal through Maxwell-Bloch Equations", 2001-2003

PI, Contracts with CEA about "Modeling a Cathode Plasma Expansion", 2000 through 2004

PI, Contracts with CEA about "Models of Ionospheric Striations", 2000 through 2004

PI, Contract with the European Space Agency "Modeling the Electrical Breakdown of Solar Generators", 99-2000

PI, Contracts with CEA about "Models of Plasma Opening Switches", 1996 through 1999

PI, Contracts with CEA "Numerical Resolution of the Fokker-Planck-Landau Collision Operator of Plasmas", 1994 through 1997

PI, Contract with Thomson-CSF (now Thales) "Semiconductor Modeling", 1992-1993

PI, Contract with DRET (now DGA (Weapons General Directorate)) "Deterministic Particle Methods", 1988-1990

PI, Contract with CNET (later become France Telecom R&D, then Orange Labs) “Particle Methods for Semiconductor Device Simulations”, 1987-1989.

#### **HABILITATION ADVISEES:**

R. Loubère, 2013; now Junior Researcher (Chargé de Recherche), CNRS, Institut de Mathématiques de Toulouse, France

M. Puel, 2011; now Full Professor at Polytech’Nice-Sophia, Nice, France

M. Delitala, 2008; now Permanent Researcher, Departement of Mathematical Sciences, Politecnico di Torino, Turin, Italy

L. Mieussens, 2007; now Full Professor, Université Bordeaux-1, France

M-H Vignal, 2007; now Assistant Professor, Université Paul Sabatier, Toulouse, France

F. Filbet, 2005; now Full Professor, Université Claude Bernard Lyon 1, France

C. Besse, 2004; now Full Professor, Université Lille 1, France

M. Lemou, 2002; now Senior Researcher (Directeur de Recherche), CNRS, Rennes, France

B. Bidégaray, 2001; now Junior Researcher (Chargée de Recherche), CNRS, Grenoble, France

F. Assous, 1998; now Full Professor, Ariel University Center of Samaria, Israel

N. Ben Abdallah, 1997. Deceased. Former position: Full Professor, Université Paul Sabatier, Toulouse, France

F. Poupaud, 1993. Deceased, Former position: Full Professor, Université de Nice Sophia Antipolis, France

#### **PhD ADVISEES:**

B. Delmotte (coadvised by E. Climent and F. Plouraboué, Fluid Mechanics Group IMFT, Toulouse), ongoing

D. Peurichard (coadvised by F. Delebecque, Institut de Mathématiques de Toulouse and L. Casteilla, Stromal Cell Research Institute “Stromalab”, Toulouse), ongoing

T-B-N. Mac (coadvised by G. Dimarco, Institut de Mathématiques de Toulouse), ongoing

M. Leroy-Lerêtre (coadvised by G. Dimarco, Institut de Mathématiques de Toulouse and V. Lobjois, Tumor Cell Proliferation Group “IP3D-ITAV”, Toulouse), ongoing

C. Sbai (coadvised by C. Jost, Animal Cognition Group “CRCA”, Toulouse), 2012. In job search

S. Possanner (formerly advised by N. Ben Abdallah and coadvised by F. Schürer, Graz, Austria), 2012; now post-doc at the Institut de Mathématiques de Toulouse.

E. Boissard (coadvised by P. Cattiaux, Probability Group, Institut de Mathématiques de Toulouse), 2011; now Post-Doc at Weierstrass Institute, Berlin, Germany.

C. Jourdana (formerly advised by N. Ben Abdallah and coadvised by P. Pietra, Pavia, Italy), 2011; now Assistant Professor at Université Joseph Fourier, Grenoble, France

F. Cordier (coadvised by A. Kumbaro, CEA, Nuclear Plant Engineering), 2011; now in the private sector

A. Frouvelle (coadvised by H. Chaté, CEA, Condensed Matter Physics), 2011; now Assistant Professor in Université Paris Dauphine, France.

L. Carballal-Perdiz (coadvised by R. Loubère, Institut de Mathématiques de Toulouse), 2010; now high-school teacher.

D. Savelief (coadvised by M-H. Vignal, Institut de Mathématiques de Toulouse), 2011; now in the private sector

L. Pebernet (coadvised by F. Rogier and X. Ferrières, ONERA (French National Office for Aeronautics and Space Studies and Research), Toulouse, 2010; now situation unknown

P. Seimandi (coadvised by F. Rogier and G. Dufour, ONERA, Toulouse), 2010; now in the private sector

L. Navoret (coadvised by D. Sanchez, Institut de Mathématiques de Toulouse), 2010; now Assistant Professor at the Université de Strasbourg

S. Motsch (coadvised by G. Théraulaz, Animal Cognition Group “CRCA”, Toulouse), 2009; now post-doc at the University of Maryland, College Park, USA.

S. Gallego (coadvised by F. Méhats, University of Rennes), 2007; now high-school teacher and university lecturer

J-C. Matéo-Velez (coadvised by F. Thivet, AONERA, Toulouse), 2006. Present permanent position at ONERA

R. Poncet (coadvised by C. Besse, University of Lille 1), 2006. Present permanent position at CEA (French Atomic Energy Commissioner)

G. Quinio (coadvised by F. Rogier, ONERA, Toulouse), 2005; now mathematics lecturer at Institut National des Sciences Appliquées (INSA), Toulouse

P. Crispel (coadvised by M-H. Vignal, Institut de Mathématiques de Toulouse), 2005; now high-school teacher

N. Crouseilles (coadvised by M. Lemou, CNRS, Rennes), 2004; now at INRIA (French National Institute for Computer Sciences and Robotics), Rennes, France

J. P. Bourgade (coadvised by L. Mieussens, University Bordeaux 1), 2004; now mathematics lecturer at Institut National Polytechnique (INP), Toulouse

O. Saut (coadvised by C. Besse, University of Lille 1), 2003; now Junior Researcher (Chargé de Recherche) at CNRS in Bordeaux, France.

C. Parzani (coadvised by M-H. Vignal, Institut de Mathématiques de Toulouse), 2003; now at INRETS (French National Institute for Transportation Research), Lyon, France

A. Mellet, 2002; now Associate Professor at the University of Maryland, College Park, USA



A. El Ayyadi, 2002; present position unknown

F. Deluzet (coadvised by N. Ben Abdallah), 2002; now Research Engineer in Scientific Computing at CNRS, Toulouse

V. Latocha (coadvised by J-P. Boeuf, Plasma Physics Group “LAPLACE”, Toulouse), 2001; now Assistant Professor at the University Nancy 1, France

D. Reignier (coadvised by B. Bidégaray, CNRS, Grenoble), 2000; now in the private sector

P. Omnès, 1999; now at CEA

P. F. Peyrard, 1998; now in the private sector

S. Génieys (coadvised by N. Ben Abdallah), 1997; now Assistant Professor at Institut National des Sciences Appliquées (INSA), Toulouse

M. Lemou, 1996; now Senior Researcher (Directeur de Recherche) at CNRS, Rennes, France

O. Maurice-Bokanowski (coadvised by J-P. Daudey, now deceased, formally in the Physics Group “LPCNO”, Toulouse), 1996; now Assistant Professor at Université Paris 7, France

S. Cordier, 1994; now Full Professor at Université d’Orléans, France

N. Ben Abdallah, 1994. Deceased. Former position: Full Professor, Université Paul Sabatier, Toulouse, France

E. Heintze, 1992; now at Institut Français du Pétrole

F. Nier, 1992; now Full Professor at Université de Rennes 1, France

F. J. Mustieles, 1990; now high-school teacher in Spain

F. Guyot-Delaurens, 1990; now at CEA

F. Poupaud, 1986. Deceased. Former position: Full Professor at Université de Nice Sophia-Antipolis, France

B. Niclot, 1986; now in the private sector

**POST-DOC ADVISEES:**

Hui Yu, 2013-2015.

B. P. Muljadi, 2012-2014.

J. Hua, 2009-2011; now Assistant Professor at Donghua University, Shanghai, China

D. Doyen, 2010-2011; now Assistant Professor at Université Paris Est Marne-la-Vallée, France

A. Mouton, 2009-2010; now a Research Engineer at CNRS, Lille, France

J. Narski, 2009-2011; now Assistant Professor at Université Paul Sabatier, Toulouse

J-M. Rovarch, 2008-2010; now in the private sector

S. Brull, 2008-2009; now Assistant Professor at Université Bordeaux 1, France

M. Tang, 2008-2009; now Assistant Professor at Shanghai Jiao-Tong University, China  
G. Dimarco, 2008-2009; now Assistant Professor at Université Paul Sabatier, Toulouse  
S. Hirstoaga, 2007-2008; now Junior Researcher at INRIA, Nancy, France  
A. Sangam, 2007-2008; now Assistant Professor at Université de Nice Sophia-Antipolis, France  
F. Loret , 2006; now in the private sector  
S. Kosuge, 2005; now Assistant Professor at Kyoto University, Japan  
S. Châble, 2004-2005; now in the private sector  
K. Zhang, 1998-1999; now Full Professor at Northwestern Normal University, Changchun, China

#### **OTHER PROFESSIONAL SERVICES:**

Committee member of the Math-Biology working group of the Scientific Council of the INSMI (Institut National des Sciences Mathématiques et de leurs Interactions), the branch of CNRS dealing with Mathematics, 2012-date.

Committee member of the Scientific Council of the Genotoul, a network of platforms in life sciences in the Toulouse area, 2011-date.

Panel Committee for the “European Mathematical Society Monograph Award” (the other committee members being John Coates, Carlos Kenig, Jaroslav Nešetřil, Michael Roeckner & Vladimir Turaev), 2012-date

Panel Committee for the Blaise Pascal prize of SMAI in 2013 (awarded by the French Academy of Sciences), 2013

Scientific and Administrative Board of the Excellence Laboratory “CIMI: Centre International de Mathématique et d’Informatique de Toulouse”, 2012-date

Scientific Board of the French Mathematical Society SMF, 2009-date

Reviewer for the ANR (French National Research Agency), 2009-date

Member of the Board in charge of the composition of the Mathematics Hiring Committees of Université Paul Sabatier, Toulouse, 2009-date.

Co-responsible of the Platform “MIBS: Modeling and Information Processing for Systems Biology”, a regional network aimed at fostering interactions between life sciences and the other sciences, 2008-date

Member of Mathematics Hiring Committees of Université Paul Sabatier, Toulouse and Institut National des Sciences Appliquées, Toulouse, 1993-date

Scientific Board of “IFCM: French-Chinese Institute of Mathematics” funded by CNRS, 2008-2012.

Review Panelist for the “Excellence Chair” Program of the ANR (French National Research Agency), 2011 & 2012

Admission Jury of the National Competition for Junior CNRS Researcher positions, 2010

Review Committee for the European Commission of the Project 'Cyberemotions' (FP7-231323), 2010

Coordinator of a Prospective Committee on 'Simulation and Modeling' for the foundation RTRA STAE ("Midi-Pyrénées"-Region Research foundation for Aeronautics and Space), 2009 (report downloadable from web page)

External Member of the Hiring Committee of the Université de Pau, 2009

Vice-Director of the Institut de Mathématiques de Toulouse in 2007 & 2008

Director of the Institut de Mathématiques de Toulouse in 2005 & 2008

President of the Review Committee (Appointed by the French Evaluation Agency AERES) of the Mathematics Laboratories of the Universities of Nancy and Metz, 2008

Review Committee (appointed by AERES) of "Collège de France", Paris, 2008

Scientific Board of "IFIM: French-Indian Institute of Mathematics", funded by CNRS, 2004-2008.

Reviewer for the Italian National Evaluation Commission CIVR, 2005

Review Panelist for the Incentive Coordinated Action Program of CNRS "New Interfaces of Mathematics", 2003 & 2004

President of the Review Committees of the Mathematics Laboratories of the University of Pau and of the "Ecole Normale Supérieure de Cachan", 2004

Review Committee for the INRIA (French National Institute for Computer Sciences and Robotics), 2004

Responsible of the construction project of a new building for the Institut de Mathématiques de Toulouse, 1993-2003

Reviewer for the NSF (USA), 2002 & 2003

Appointed Member of the National CNRS Committee (in charge of hiring and promotions), 1998-2002 (member of the Bureau of the Committee in 2001 & 2002; the Bureau is in charge of assigning the work to the Committee Members)

Founder and Director of the CNRS laboratory MIP (Mathematics for Industry and Physics) in Toulouse (now part of the Institut de Mathématiques de Toulouse), 1993-2000

Vice-Director of the CNRS Network "GDR SPARCH" (Interdisciplinary Network on Charged Particle Transport), 1992-1998

Review Panelist in the National Committee for the Evaluation of Laboratories, under the auspices of the Ministry of Higher Education and Research, 1996 & 1997

Mathematics Hiring Committees of Ecole Normale Supérieure de Cachan, Université d'Orléans, Université de Nice, Université Bordeaux-1, 1990-1996

Review Panelist in the National Committee for PhD Grants, under the auspices of the Ministry of Higher Education and Research, 1992 & 1993

## CONFERENCES ORGANIZED:

Scientific Committee, “Collective Behavior: Macroscopic versus Kinetic Descriptions”, Imperial College, London, UK, 19-23 May 2014

Scientific Committee, “the 10th conference on Traffic and Granular Flow”, Jülich, Germany, 25-27 Sept. 2013

Scientific Committee, “The 14th International Conference on Hyperbolic Problems: Theory, Numerics and Applications”, Padova (Italy), June 25-29, 2012.

Organizing committee of the Program “Multiscale Modeling, Simulation, Analysis and Applications”, Institute for Mathematical Sciences, National University of Singapore, December 1, 2011 to January 31, 2012.

Organizing Committee of the Workshop “Collective Behavior in Active Agent Systems from Experiments to Models”, Université Paul Sabatier, Toulouse, November 16-17, 2011.

Scientific Committee of the Workshop “Multi-Agent Cooperation (COMUL)”, Université Toulouse Capitole, Toulouse, September 26-27, 2011.

Organizing Committee of the Workshop “Vlasov Models in Kinetic Theory”, Institute for Computational and Experimental Research in Mathematics, Brown University, Providence, September 19-23, 2011.

Scientific Committee, “SMAI 2011 National Congress”, May 23-27, 2011.

Co-Organizer of the Workshop “Kinetic Models of Classical and Quantum Particle Systems, A conference in Memory of Naoufel Ben Abdallah”, Toulouse, March 14-18, 2011

Organization of a Working Seminar on “Mathematical Modeling of Transport Phenomena”, 2006-2009 (and Sporadically since 2010)

Scientific Committee of the Conference “OKASE: Optimal Transport and Kinetics Applied to Socio-Economics”, Université Toulouse 1 - Capitole, Sept. 1-3, 2010

Co-Organizer, of the “Workshop on Pedestrian Traffic Flows”, SAMSI (Statistical and Applied Mathematical Sciences Institute), Research Triangle Park, NC, USA, February 14-16, 2011.

Scientific Committee of the SAMSI Program on “Complex Networks”, SAMSI, Research Triangle Park, NC, USA, 2010-2011.

Co-organizer of the Workshop: “Modeling Complex Dynamics in Biological Systems”, June 7-9, 2010, Université Paul Sabatier, Toulouse and of the Companion Workshop “Mathematics of Complex Systems”, June 10, 2010.

Scientific Committee of the Conference on “Advanced Methods and Perspectives in Non-linear Optimization and Control”, February 3-5, 2010, Toulouse, France

Co-Organizer of the School “Topics in Kinetic Theory”, Victoria (Canada), under the auspices of the PIMS (Pacific Institute of Mathematical Sciences), June 2009

Scientific Committee of the Program “Quantum and Kinetic Transport”, at IPAM (Institute for Pure and Applied Mathematics), University of California at Los Angeles, March to June 2009

Organizing Committee, Fall Inter-Disciplinary School of Systems Biology, Aspet, France, October 2008

Scientific Committee, “The 12th International Conference on Hyperbolic Problems: Theory, Numerics and Applications”, Maryland, June 2008

Scientific Committee, “The 6th International Conference on Industrial and Applied Mathematics (ICIAM)”, Zürich, July 2007

Co-Organizer of the Summer School ‘Multiscale Modeling’, Cargèse, Corsica, August 2006

Co-Organizer of the Summer School ‘Plasma Physics and Applications’, Cargèse, Corsica, October 2004

Organizing Committee, Conference “MAFPD: Mathematical Aspects of Fluid and Plasma Dynamics”, Kyoto, Japan, September 2004

Scientific Committee, Spring School on Nano-Electronics “Nanolab”, Toulouse, May 2003

Co-Organizer, Oberwolfach Workshop on “Methods in Kinetic Equations”, Oberwolfach, Germany, April 2001

Scientific Committee, Workshop “Simulation in Transition Regimes”, Minneapolis, May 2000

Organizing Committee, “31st National Congress of Numerical Analysis”, Ax-les-Thermes, France, May 1999

Scientific Committee, CIME Course on “Semiconductor Modeling”, Cetraro, Italy, July 1998

Co-Organizer, “First European Symposium on Applied Kinetic Theory”, Toulouse, May 1998

Co-Organizer, Workshop of GDR SPARCH Network on “Magnetohydrodynamics”, Ecole Polytechnique, Palaiseau, France, January 1996

Co-Organizer, Workshop of GDR SPARCH Network on “Charged-Particle Transport”, Aspet, France, May 1994

Co-Organizer, Opening Workshop of GDR SPARCH Network, ENS-Cachan, June 1992

Co-Organizer, Workshop on Mathematical Models and Numerical Simulation of Semiconductors, Ecole Polytechnique, Palaiseau, May 1989

#### **INVITED CONFERENCE SPEECHES:**

One-day workshop SMAI-INRIA “Des lauréats des prix en mathématiques et en informatique-2013”, Collège de France, Paris, December 18, 2013.

One-day workshop organized by the French Mathematical Society SMF “Des mathématiciens primés par l’Académie des Sciences - 2013”, Nancy (France), December 11, 2013.

Workshop “Classical and Quantum Mechanical Models of Many-Particle Systems”, Oberwolfach (Germany), December 1-7, 2013

Series of Lectures (5 hours) at "Pattern formation and self-organization in living systems", Swiss Doctoral School in Mathematics, Ovornnaz, Switzerland, August 28-31, 2013

Series of Lectures (5 hours) at ESMTB-EMS Summer school: "Multiscale modeling in the life sciences", Lyon, May 27-31, 2013,

"National Congress of the Société des Mathématiques Appliquées et Industrielles (SMAI 2013)", Seignosse, France, 27-31 May 2013

Conference "Mathematical Methods and Modeling of Biophysical Phenomena", Cabo Frio, Rio de Janeiro, Brazil, 3-9 March 2013

Workshop "Animal Swarms, An international, multidisciplinary workshop dedicated to the understanding of animal swarming", Kfar Blum, Upper Galilee, Israel, February 18-21, 2013

Workshop, "Transport Models for Collective Dynamics in Biological Systems", North Carolina State University, Raleigh, USA, Jan 15-18, 2013

Workshop, Université Paris 6, 'A Day on Cell-Motion', Paris, France, Dec. 2012

Series of Lectures (5 hours) at "Biomat 2012: Self-Organization and Collective Dynamics in the Life Sciences: Swarms, Biofilms, Traffic", Granada, Spain, July 2-6 2012 (keynote lecture)

Workshop "Topics in compressible Navier-Stokes equ.", Le Bourget-du-Lac, France, 21-25 May 2012

Workshop "Functional Inequalities and PDE in the Life Sciences", Paris-Dauphine, France, Jan. 12-13, 2012

Workshop "Multi-Agent Cooperation (COMUL)", Université Toulouse Capitole, France, Sept. 26-27, 2011

Course (10 hours) "Challenges in the Modeling of Complex Systems", Tsinghua university, Beijing, China, May 2011

Minisymposium Session "Mathematics and Collective Behavior", AAAS Annual Meeting, Washington DC, USA, Feb. 2011

Workshop "Pedestrian Traffic Flow", SAMSI (Statistical and Applied Mathematical Sciences Institute), Research Triangle Park, North Carolina, USA, Feb. 14-16, 2011

2nd Swedish Meeting on "Mathematics in Biology and Medicine", Gothenburg, Sweden, Dec. 16-17, 2010

Workshop "Classical and Quantum Mechanical Models of Many-Particle Systems", Mathematisches Forschungsinstitut Oberwolfach, Germany, Dec. 5-11, 2010

Conference "PDE's in Kinetic Theories: Kinetic Description of Biological Models", International Centre for Mathematical Sciences, Edinburgh, UK, Nov. 8-12, 2010

Workshop on "Conservation Laws, Plasmas and Related Fields", Seoul, South Korea, Oct. 2010; Intensive Lectures (3 hours) and Workshop (invited lecture)

Conference "Fluid-Kinetic Modeling in Biology, Physics and Engineering", Newton Insti-

tute, Cambridge, UK, Sept. 2010

Workshop “OKASE: Optimal Transport Applied to Socio-Economics”, Université Toulouse 1, France, Sept. 1-3, 2010

Opening Tutorials & Workshop of the “2010-11 Program on Complex Networks”, SAMSI, Research Triangle Park, North Carolina, USA, Aug. 29 - September 1st, 2010.

Summer School CEMRACS 2010: “Numerical Methods for Fusion Energy”, Centre International de Rencontres Mathématiques (CIRM), Luminy, France, July 19-23, 2010 (keynote speaker: 6 hour lecture)

Minisymposia on “Particle and Mean Field Models for Flocking and Swarming” and on “High-Order Time-Stepping Schemes and Applications” at “DSPDES’10: Emerging Topics in Dynamical Systems and PDE’s”, Barcelona, Spain, May 31 - June 4 2009

Conference “CMMSE 2010: 10-th International Conference on Computational and Mathematical Methods in Science and Engineering”, University of Wisconsin-Madison, USA, May 24-26, 2010

Minsymposium Session on “Traffic, Crowds and Society”, AAAS Annual Meeting, San-Diego, USA, Feb. 2010

“The Third Winter School on Applied Mathematics”, Hong-Kong City-University, 7-11 Dec. 2009 (keynote speaker: 8 hour lectures)

Workshop “Agent-Based Complex Systems”, Institute for Pure and Applied Mathematics, UCLA, Los Angeles, USA, Oct. 12-17, 2009

Meeting “Asymptotics in Complex Systems”, Corinaldo, Italy, Sept. 2009

Workshop “Kinetic Description of Multiscale Phenomena”, University of Maryland, College Park, USA, Sept. 2009

Workshop “New Trends in Model Coupling”, Institut Henri Poincaré, Paris, Sept. 2-4, 2009

Summer School “Kinetic and Statistical Methods for Complex Systems”, Lisbon, Portugal, July 2009:

PIMS/Accelerate Canada Summer School in PDE “Topics in Kinetic Theory”, Victoria, Canada, July 2009

Conference “CLKE’08, Conservation Laws & Kinetic Equations”, Jiao-Tong University, Shanghai, China, Dec. 2008

Conference “International Conference on PDE”, in the Honor of P. Ciarlet, City University of Hong-Kong, Dec. 2008

Mini-Workshop “Numerics for Kinetic Equations”, Mathematisches Forschungsinstitut Oberwolfach, Germany, Nov. 2008

Workshop “Gyrokinetic Plasma Turbulence”, Wolfgang Pauli Institute, Vienna, Austria, Sept. 2008

CEA-EDF-INRIA School on “Controlled Fusion ”, Nice, France, Sept. 2008

Workshop “Numerical Methods for Nonlinear Hyperbolic PDE’s”, Banff, Canada, Sept. 2008

Summer School of the Research Network GDR Chant “Challenges in Applied Mathematics”, Roscoff, France, Aug. 2008

Conference “BAIL 2008: Boundary and Interior Layers”, Limerick, Ireland, July 2008

Workshop “Kinetic Equations: Direct and Inverse problems”, Mantova, Italy, May 2008

Workshop “Multiscale Problems and Models in Traffic Flow”, Wolfgang Pauli Institute, Vienna, Austria, May 2008

Symposium “Models and Measurements in Traffic”, Université d’Orsay, Orsay, France, April 2008

Workshop “Computational Fluid Mechanics Seminar CEA/SMAI/GAMNI”, Institut Henri Poincaré, Paris, France, Jan. 2008

Minsymposium “Control Problems for fluidodynamic models” at the “6th ICIAM: International Congress on Industrial and Applied Mathematics”, Zürich, 16-20 July 2007

First Colloquium of the “Rhones-Alps Institute of complex systems”, Lyon, France, June 2007

2007 Clifford conferences, Tulane, New-Orleans, March 2007

Workshop “Computational High Frequency Waves”, Wolfgang Pauli Institute, Vienna, Austria, Feb. 2007

Workshop “Kinetic Equations”, Saarbrücken, Germany, Feb. 2007

Workshop “Computational Electromagnetism and Acoustics”, Mathematisches Forschungsinstitut Oberwolfach, Germany, Feb. 2007

Workshop “Classical and Quantum Mechanical Models of Many-Particle Systems”, Mathematisches Forschungsinstitut Oberwolfach, Germany, Dec. 2006

Series of Lectures, Beijing Univeristy, Beijing, China, Oct. 2006

CIME Course on “Quantum Transport” Cetraro, Italy, Sept. 2006

Conference of the “ECMI 2006: European Consortium for Mathematics in Industry”, Madrid, Spain, July 2006

Workshop “Nonlinear PDEs: Homogenization and Kinetic Equations”, Vienna, Austria, June 2006

Series of lectures in “ERCOFTAC lectures”, ETH Zürich, Switzerland, Jan. 2006

Workshop “Multiscale Analysis and Computation”, Institute for Pure and Applied Mathematics, UCLA, Los Angeles, USA, Nov. 2005

Workshop “Mathematical Models of Traffic Flow”, Nice, France, Nov. 2005

Summer School CEA-EDF-INRIA on “Kinetic Equation”, Rocquencourt, France, Sept. 2005



Conference “High-dimensional PDE’s”, Centre de Recherches Mathématiques, Université de Montréal, Canada, Aug. 2005

Workshop “Nonlinear PDES”, Capital Normal University, Beijing, July 2005

Summer Course, Morningside Institute and Tsinghua University, Beijing, China, July 2005

Workshop “Information in Complex Networks” Goldrain Castle, Italy, June 2005

Summer Course, University of Granada, Spain, June 2005

Workshop “Kinetic Equations”, Mantova, Italy, May 2005

Third Annual Meeting of the HYKE Network, Roma, Italy, April 2005

Workshop “Computational Transport”, University of Texas at Austin, USA, March 2005

Workshop of the Institute of Mathematical Sciences, National University of Singapore, Singapore, Jan. 2005

Workshop “Numerical Simulations in Plasmas”, Nice, France, Dec. 2004

Conference AMASIS, Weierstrass Institute of Applied Analysis and Stochastics, Berlin, July 2004

Workshop on Kinetic Theory, Fields Institute, Toronto, Canada, March 2004

Conference “Numerical Methods for Plasmas”, CSCAMM, University of Maryland, College Park, USA, March 2004

Conference on “Semiconductor Modeling”, Sino-German center, Tsinghua University, Beijing, China, March 2004

Workshop “Classical and Quantum Mechanical Models of Many-Particle Systems”, Mathematisches Forschungsinstitut Oberwolfach, Germany, Nov. 2003

Summer School CEMRACS 2003, Centre International de Rencontres Mathématiques (CIRM), Luminy, France, July 2003 (series of three lectures)

Minsymposium at the at the “ICIAM: International Congress on Industrial and Applied Mathematics”, Sydney, Australia, July 2003

International Conference on “Nonlinear Evolution Equations”, Northwestern University, Evanston, USA, June 2003

Opening Conference of the European Network “HYKE”, Vienna, Austria, Feb. 2003

Workshop “Linear and Nonlinear Hyperbolic Systems”, Potsdam, Germany, Oct. 2002

CIME Summer School: “Kinetic Models”, Piano di Sorrento, Italy, Sept. 2002 (8 hours)

Workshop “Currents in Quantum Dynamics”, CECAM, Lyon, France, Sept. 2002

Conference “SIAM 50: The 50-th SIAM Conference”, Philadelphia, USA, July 2002

Conference “FBP 2002: Free Boundary Problems”, Trento, Italy, June 2002

Conference “Hyp 2002 Ninth International Conference on Hyperbolic Problems Theory, Numerics, Applications”, Caltech, Pasadena, USA, March 2002

Workshop of the TMR European Network on “Kinetic Theory”, Saarbrücken, Germany, Nov. 2001

Conference in the Honor of C. Bardos, Institut Henri Poincaré, Paris, France, Sept. 2001

Summer School of the TMR European Network in Kinetic Theory, Anogia, Crete, Greece, June 2001

Conference “Propagation in Heterogeneous Media”, Institut Henri Poincaré, Paris, France, May 2001

Workshop on “Advances in Semiconductor Modeling”, Pavia, Italy, Sept. 2000

Minsymposium on “Kinetic Equations”, “2000 SIAM Annual Meeting”, Puerto-Rico, USA, July 2000

Workshop on “Simulation of Transition Regimes”, Institute of Mathematics and their Applications, University of Minnesota, Minneapolis, USA, May 2000

Conference “Hyp 2000 International Conference on Hyperbolic Problems Theory, Numerics, Applications”, Magdeburg, Germany, March 2000

Workshop on “Mathematical Aspects of Hyperbolic Problems”, Mathematisches Forschungsinstitut Oberwolfach, Germany, May 1999

Workshop on “Wigner measures”, Centre International de Rencontres Mathématiques (CIRM), Luminy, France, March 1999

Workshop on “Kinetic models”, Erwin Schrödinger Institute, Vienna, Austria, Oct. 1998

series of lectures at the Morningside Institute, The Chinese Academy of Sciences, Beijing, Aug. 1997

Conference “15-th International Conference on Transport theory”, Gothenburg, Swede, June 1997

Series of Lectures, Thematic School on “Kinetic Models”, Besançon, France, April 1997

Workshop of the Research Network GDR SPARCH on “Electrical Discharges and Ionic Propulsion”, Nice, France, April 1997

Workshop “Classical and Quantum Mechanical Models of Many-Particle Systems”, Mathematisches Forschungsinstitut Oberwolfach, Germany, Dec. 1996

European Workshop on Kinetic Equations, Granada, Spain, April 1996

Workshop on Kinetic Equations for Semiconductors, Vienna, Austria, Nov. 1995

Third Summer School of the Network GDR SPARCH, Aussois, France, Sept 1995 (series of lectures)

Plenary talk, “ICIAM: International Congress on Industrial and Applied Mathematics”, Hamburg, July 1995

Workshop “Kinetic Equations”, Kaiserslautern, Germany, June 1995

Workshop on “Mathematical Models for Semiconductors”, L’Aquila, Italy, May 1995

Workshop on “Kinetic Theory”, Institute of Advanced Study, Princeton, USA, march 1995

2nd International workshop on “Nonlinear Kinetic Theories”, San Remo, Italy, Sept. 1994

Summer School CEA-EDF-INRIA on “Electromagnetism”, Rocquencourt, France, April 1994 (series of lectures)

School on “Mathematical Problems in Semiconductor Simulations”, Roma, Dec. 1993

Workshop “Classical and Quantum Mechanical Models of Many-Particle Systems”, Mathematisches Forschungsinstitut Oberwolfach, Germany, Dec. 1993

Workshop “Multicomponent Systems”, Sienna, Italy, Sept. 1993

First Summer School of the Research Network GdR SPARCH, Oléron, France, Sept 1993 (series of lectures)

Conference “Equadiff 8”, Bratislava, Slovakia, Aug. 1993 (plenary talk)

Conference “25-th CANUM: National Conference on Numerical Analysis”, Giens, France, May 1993, (plenary talk)

International School on Fluids and Semiconductors, Sienna, Italy, Oct. 1992

Workshop “Electromagnetics and Plasmas”, San-Damiano, California, USA, July 1992

Minymposium at the “24-th CANUM: National Conference on Numerical Analysis”, Vit-tel, France, May 1992

Workshop “Asymptotic Induced Numerical Methods”, Beaune, France, May 1992

Conférence “NASECODE VIII: Numerical Analysis of Semiconductor Equations”, Vienna, Austria, May 1992

School on “Modeling in Plasma Engineering”, Centre International de Rencontres Mathématiques (CIRM), Luminy, Nov. 1991

Workshop “Kinetic Equations”, Lambrecht, Germany Oct. 1991

Conference “14 th International Conference on Numerical Simulation of Plasmas”, Annapolis, Sept 1991

Workshop, Institute of Mathematics and their Applications, University of Minnesota, Minneapolis, July 1991

Minisymposium “2nd World Conference in Computational Mechanics, Stuttgart, Germany, August 1990

Conference, “9th International Conference on Computing Methods in Applied Sciences and Engineering”, Paris, France, Jan. 1990

Conference ”8-th Symposium on Computational Mathematics”, Pavia, Italy, Oct. 1989

INRIA School on Kinetic Models, Rocquencourt, France, June 1989

Workshop “Mathematical Modeling and Simulation of Semiconductor Devices” Mathematisches ForschungsInstitut Oberwolfach, Nov. 1988

Conference “2-nd MAFPD: International Conference on Mathematical Aspects of Fluid and Plasma Dynamics MAFPD” Salice Terme, Italy, Sept. 1988

Summer School CEA- EDF-INRIA on “Particle Methods”, Le Bréau-sans-Nappe, France, July 1987

AMS-SIAM-IMA Summer Seminar on VLSI Design, Minneapolis, may 1987

Conference on “Kinetic Equations”, ENS, Paris, France, June 1985

Workshop on “Mathematical Methods in Kinetic Theory”, Mathematisches Forschungsinstitut Oberwolfach, June 1985

#### **INVITED COLLOQUIA AND SEMINAR TALKS:**

Graduate course, Imperial College London, October 2013

Département de Math, Universita di Corsica Pasquale Paoli, Corte, Juin 2013

Laboratory ‘Stromalab’ (biology), Université Paul Sabatier, Toulouse, France, April 2013

Paris-London analysis seminar, Imperial College London, March 2013

Dynamical Systems Seminar, Université de Nice Sophia Antipolis, Nice, France, Nov. 2012

Séminaire Laurent Schwartz, Ecole Polytechnique, Palaiseau, France, Oct. 2012

Universitat Autònoma de Barcelona, Spain, April 2011

University of Texas at Austin, TX, USA, Feb. 2011.

SAMSI, Research Triangle Park, NC, USA, Feb. 2011

Laboratory Jean Kuntzmann, Grenoble, France, Jan. 2011.

EHESS (School of Higher Studies in Social Sciences), Paris, June 2010

University of Orleans, France, March 2010

University of California at Los Angeles, USA, Feb. 2010

Stanford University, USA, Feb. 2010

Duke University, USA, “Adventures in Theory Lectures” (public lecture), Feb. 2010

Orsay University, France, Feb. 2010

Kyoto University, Japan, Oct. 2009

Ecole Normale Supérieure de Cachan, France, Jan. 2009

Ecole Normale Supérieure de la rue d’Ulm, Paris, France, March 2008

Université de Bordeaux-1, France, Jan. 2008

Ecole Normale Supérieure de Cachan, France, Jan. 2008

CEA (Atomic Energy Commissioner), Saclay branch (Nuclear plant division), France, Sept. 2007

Chalmers University of Göteborg, Sweden, Sept. 2007

Université de Lille 1, France, June 2007

Kyoto University, Japan, May 2007

Chinese University of Hong-Kong, Hong-Kong, April 2007  
Hong-Kong Polytechnic University, Hong-Kong, April 2007  
Colloquium, City University of Hong-Kong, Hong-Kong, April 2007  
Capital Normal University, Beijing, China, Oct. 2006  
Beijing University of Technology, Beijing, China, Oct. 2006  
Chinese Academy of Science, Beijing, China, Oct. 2006  
Ecole Polytechnique Fédérale de Lausanne, Switzerland, Jan 2006  
Colloquium, University of Maryland (College Park), Nov. 2005  
Ecole Normale Supérieure de Cachan, Brittany branch, Ker-Lann, France, Oct. 2005  
Physics seminar, Université Paul Sabatier, Toulouse, France, May 2005  
Université Paris 6, France, March 2005  
Applied Mathematics Center, Ecole Polytechnique, Palaiseau, France, June 2004  
Colloquium, Weierstrass Institute, Berlin, Germany, Dec. 2003  
University of Bonn, Germany, Nov. 2003  
University of Maryland, College Park, June 2003  
University of Wisconsin-Madison, USA, April 2003  
Arizona State University, Tempe, April 2003  
Kyoto University, Japan, Jan. 2003  
National University of Singapore, Jan. 2003  
Laser-plasma Institute, Université de Bordeaux 1, Sept. 2002  
CEA (Atomic Energy Commissioner), Military Branch, Bruyères-le-Châtel, France, June 2002  
Arizona State University, Tempe, USA, March 2002  
University of Texas, Austin, USA, March 2002  
Dublin City University, Ireland, Jan. 2002  
CEA (Atomic Energy Commissioner), Civil Branch, Saclay, France, Dec. 2001  
Weierstrass Institute, Berlin, Germany, Dec. 2001  
Université de Nice, France, March 2001  
University of Texas, Austin, USA, Feb. 2001  
University of Wisconsin-Madison, USA, Feb. 2001  
Yokohama University, Japan, Nov. 2000  
Kyoto University, Japan, Oct. 2000  
Université de Paris-Sud Orsay, France, June 2000

Université de Rennes 1, France, April 2000  
Université de Bordeaux 1, France, March 2000  
CEA (Atomic Energy Commissioner), Military Branch, Le Barp, France, May 1999  
CERFACS (European Center for Research and Advanced Training in Scientific Computing), Toulouse, Feb. 1999  
Université de Aix-Marseille 1, Chateau-Gombert, France, Jan. 1999  
Collège de France, Paris, France, March 1998  
Université de Aix-Marseille 1, Chateau-Gombert, France, Nov. 1997  
Peking University, Beijing, China, Aug. 1997  
IBM Research Center, Yorktown Heights, USA, May 1997  
Brown University, Providence, USA, Mai 1997  
Colloquium, Courant Institute, New-York, USA, May 1997  
Ecole Polytechnique Fédérale de Lausanne, Switzerland, Feb. 1997  
Ecole Normale Supérieure de Cachan, France, Feb. 1996  
CNR Pavie, Italy, Jan. 1996  
Université de Bordeaux 1, France, Jan. 1996  
Ecole Polytechnique Fédérale de Lausanne, Switzerland, Oct. 1995  
IBM Research Center, Yorktown Heights, USA, April 1995  
Applied Mathematics Seminar, Courant Institute, New-York, March 1995  
Institute of Advanced Study, Princeton, USA, March 1995  
Ecole Normale Supérieure de Lyon, France, Nov. 1994  
Ecole Polytechnique Fédérale de Lausanne, Switzerland, June 1994  
Technical University, Berlin, Germany, May 1994  
Humboldt University, Berlin, Germany May 1994  
Université de Pau, France, Feb. 1994  
Electronics and microelectronics laboratory, Université de Lille 1, France, Jan. 1994  
Université de Bordeaux 1, France, Jan. 1994  
Physics group “IRSAMC”, Université Paul Sabatier, Toulouse, Jan. 1994  
Ecole Normale Supérieure de Cachan, France, March 1993  
Technical University, Berlin, Germany, Feb. 1993  
Université Paul Sabatier, Toulouse, France, Jan. 1993  
Technical University of Vienna, Austria, May 1992  
CNR Roma, Italy, April 1991

Université Paul Sabatier, Toulouse, France, March 1991  
 Ecole Polytechnique, Palaiseau, France, 1990  
 Ecole Normale Supérieure de Cachan, France, March 1990  
 Université de Grenoble 1, France, March 1990  
 Université de Nice, France, Feb. 1990  
 Physics group, Université Paul Sabatier, Toulouse, France, Oct. 1989  
 INRIA, Rocquencourt, France, Oct. 1989  
 Université Paris 6, France, Jan. 1989  
 Ecole Polytechnique, Palaiseau, France, Jan. 1989  
 Technical University Vienna, Austria, June 1988  
 Ecole Normale Supérieure de la rue d'Ulm, Paris, France, Dec. 1987  
 IBM research center, Yorktown Heights, USA, June 1987  
 Courant Institute, New-York, USA, April 1987  
 'Partial Differential Equations' seminar, Ecole Polytechnique, Palaiseau, France, April 1986  
 Université Paris 6, France, 1986  
 Technical University, Kaiserslautern, Germany, 1985  
 Université de Franche-Comté, Besançon, France, 1985  
 Université Paris 6, France, 1985  
 Ecole Polytechnique, Palaiseau, France, 1984  
 Université Paris-Sud, Orsay, France, 1984  
 Université Paris 6, France, 1983  
 Ecole Polytechnique, Palaiseau, France, 1983  
 Ecole Normale Supérieure de la rue d'Ulm, Paris, France, 1983  
 Ecole Polytechnique, Palaiseau, France, 1982

## PUBLICATIONS:

### In refereed journals

When available, journal name abbreviations are taken from <http://www.ams.org/msnhtml/serials.pdf>

- [1] C. Bardos, P. Degond : *Global existence for the Vlasov-Poisson equation*, Ann. Inst. H. Poincaré Anal. Non Linéaire, 2 (1985), pp. 101-118.
- [2] P. Degond, *Spectral theory of the linearized Vlasov-Poisson equation*, Trans. Amer. Math. Soc., 294 (1986), pp. 435-453.

- [3] P. Degond, *Local existence of solutions of the Vlasov-Maxwell equations and convergence to the Vlasov-Poisson equations for infinite light velocity*, Math. Methods Appl. Sci., 8 (1986), pp.533-558.
- [4] P. Degond, *Global existence of solutions for the Vlasov-Fokker-Planck equation in 1 and 2 space dimensions*, Ann. Sci. Éc. Norm. Supér., 19 (1986), pp. 519-542.
- [5] P. Degond, S. Mas-Gallic, *Existence of solutions and diffusion approximation for a Model Fokker-Planck equation*, Transport Theory Statist. Phys., 16 (1987), pp. 589-636.
- [6] J. Batt, H. Berestycki, P. Degond, B. Perthame, *Some families of solutions of the Vlasov- Poisson system*, Arch. Ration. Mech. Anal., 104 (1988), pp. 79-103.
- [7] B. Niclot, P. Degond, F. Poupaud, *Deterministic particle simulations of the Boltzmann Transport Equation of semiconductors*, J. Comput. Phys., 78 (1988), pp. 313-349.
- [8] P. Degond, B. Niclot, *Numerical analysis of the weighted particle method applied to the semiconductor Boltzmann equation*, Numer. Math., 55 (1989), pp. 599-618.
- [9] P. Degond, S. Mas-Gallic, *The weighted particle method for convection-diffusion equations, part 1: the case of an isotropic viscosity*, Math. Comp., 53 (1989), pp. 485-507.
- [10] P. Degond, S. Mas-Gallic, *The weighted particle method for convection-diffusion equations, part 2: the anisotropic case*, Math. Comp., 53 (1989), pp. 509-525.
- [11] P. Degond, F. J. Mustieles, *A deterministic approximation of diffusion equations using particles*, SIAM J. Sci. Stat. Comput., 11 (1990), pp. 293-310.
- [12] P. Degond, F. Guyot-Delaurens, *Particle simulations of the semiconductor Boltzmann equation for one dimensional inhomogeneous structures*, J. Comput. Phys., 90 (1990), pp. 65-97.
- [13] P. Degond, P. A. Markowich, *A quantum transport model for semiconductors : the Wigner-Poisson problem on a bounded domain*, RAIRO Modélisation Mathématique et Analyse Numérique, 6 (1990), pp. 697-709.
- [14] P. Degond, F. Guyot-Delaurens, F. J. Mustieles, F. Nier, *Particle simulation of bidimensional electron transport parallel to a heterojunction interface*, COMPEL, 9 (1990), pp. 109-116.
- [15] P. Degond, P. A. Raviart, *An asymptotic analysis of the one-dimensional Vlasov-Poisson system : the Child-Langmuir law*, Asymptot. Anal., 4 (1991), pp. 187-214.
- [16] P. Degond, F. J. Mustieles, *A deterministic particle method for the kinetic model of semiconductors : the homogeneous field model*, Solid State Electronics, 34 (1991), pp. 1335-1345.
- [17] P. Degond, F. Hermeline, P. A. Raviart, J. Segré, *Numerical modeling of axisymmetric electron beam devices using a coupled particle-finite element method*, IEEE Trans. on Magnetics, 27 (1991), pp. 4177-4180.
- [18] P. Degond, P. A. Markowich, *A mathematical analysis of quantum transport in three dimensional crystals*, Ann. Mat. Pura Appl., 160 (1991), pp. 171-191.



- [19] A. Adolf, P. Degond, F. Hermeline, J. Marilleau, P. A. Raviart, J. Segré, *New PIC codes on unstructured meshes applied to the simulation of a photocathode injector*, Nuclear Instruments and Methods in Physics Research, A304 (1991), pp. 297-299.
- [20] P. Degond, P. A. Raviart, *An analysis of the Darwin model of approximation to Maxwell's equations*, Forum Math., 4 (1992), pp. 13-44.
- [21] P. Degond et B. Lucquin-Desreux, *The Fokker-Planck asymptotics of the Boltzmann collision operator in the Coulomb case*, Math. Models Methods Appl. Sci., 2 (1992), pp 167-182.
- [22] P. Degond, P. A. Raviart, *On a penalization of the Child-Langmuir emission condition for the one-dimensional Vlasov-Poisson equation*, Asymptot. Anal., 6 (1992), pp. 1-27.
- [23] F. Assous, P. Degond, J. Segré, *A particle method for the 3D Vlasov equation on unstructured meshes*, Comput. Phys. Comm., 72 (1992), pp. 105-114.
- [24] P. Degond et P. A. Raviart, *The paraxial approximation of the Vlasov-Maxwell equations*, Math. Models Methods Appl. Sci., 3 (1993), pp. 513-562.
- [25] P. Degond, P. A. Markowich, *A steady-state potential flow model for semiconductors*, Ann. Mat. Pura Appl., 165 (1993), pp. 87-98.
- [26] F. Assous, P. Degond, E. Heintzé, P. A. Raviart, J. Segré, *On a finite-element method for solving the three-dimensional Maxwell equations*, J. Comput. Phys., 109 (1993), pp. 222-237.
- [27] P. Degond, B. Lucquin-Desreux, *An entropy scheme for the Fokker-Planck collision operator of plasma kinetic theory*, Numer. Math., 68 (1994), pp. 239-262.
- [28] N. Ben Abdallah, P. Degond, C. Schmeiser, *On a mathematical model for hot carrier injection in semiconductors*, Math. Methods Appl. Sci., 17 (1994), pp. 1193-1212.
- [29] N. Ben Abdallah et P. Degond, *The Child-Langmuir law for the Boltzmann equation of semiconductors*, SIAM J. Math. Anal., 26 (1995), pp. 364-398.
- [30] S. Cordier, P. Degond, P. A. Markowich, C. Schmeiser, *Traveling wave analysis and jump relation for the Euler-Poisson model in the quasineutral limit*, Asymptot. Anal., 11 (1995), pp. 209-240.
- [31] P. Degond, S. Jaffard, F. Poupaud, P. A. Raviart, *The Child-Langmuir asymptotics of the Vlasov-Poisson equation for cylindrically or spherically symmetric diodes ; part 1 : statement of the problem and basic estimates*, Math. Methods Appl. Sci., 19 (1996), pp. 287-312.
- [32] P. Degond, S. Jaffard, F. Poupaud, P. A. Raviart, *The Child-Langmuir asymptotics of the Vlasov-Poisson equation for cylindrically or spherically symmetric diodes ; part 2 : analysis of the reduced problem and determination of the Child-Langmuir current*, Math. Methods Appl. Sci., 19 (1996), pp. 313-340.
- [33] P. Degond, B. Lucquin-Desreux, *The asymptotics of collision operators for two species of particles of disparate masses*, Math. Models Methods Appl. Sci., 6 (1996), pp. 405-436.
- [34] N. Ben Abdallah, P. Degond, S. Génieys, *An energy-transport model for semiconductors derived from the Boltzmann equation*, J. Stat. Phys., 84 (1996), pp. 205-231.

- [35] N. Ben Abdallah, P. Degond, A. Yamnahakki, *The Child-Langmuir law as a model for electron transport in semiconductors*, Solid State Electronics, 39 (1996), pp. 737-744.
- [36] P. Degond, F. Poupaud, C. Schmeiser, A. Yamnahakki, *Asymptotic analysis of kinetic equations for modeling a Schottky diode*, Asymptot. Anal., 13 (1996), pp. 79-94.
- [37] P. Degond, F. Poupaud, A. Yamnahakki, *Particle simulation and asymptotic analysis of kinetic equations for modeling a Schottky diode*, RAIRO Modélisation Mathématique et Analyse Numérique, 30 (1996), pp. 763-795.
- [38] N. Ben Abdallah, P. Degond, *On a hierarchy of macroscopic models for semiconductors*, J. Math. Phys., 37 (1996), pp. 3306-3333.
- [39] P. Degond, B. Lucquin-Desreux, *Transport coefficients of plasmas and disparate mass binary gases*, Transport Theory Statist. Phys., 25 (1996), pp. 595-633.
- [40] F. Assous, P. Degond, J. Segré, *Numerical approximation of the Maxwell equations in inhomogeneous media by a P1 conforming finite element method*, J. Comput. Phys., 128 (1996), pp. 363-380.
- [41] S. Cordier, P. Degond, P. A. Markowich, C. Schmeiser, *Traveling wave analysis of an isothermal Euler-Poisson model*, Ann. Fac. Sci. Toulouse Math., 5 (1996), pp. 599-643.
- [42] N. Ben Abdallah, P. Degond, P. Markowich, *On a one-dimensional Schrödinger-Poisson scattering model*, Z. Angew. Math. Phys., 48 (1997), pp. 135-155.
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# Research Summary

## Pierre Degond

### RESEARCH METHODOLOGY:

Since the very beginning, my approach has been to use mathematics and mathematical tools to investigate phenomena outside mathematics, be they natural (physical, biological, etc.) or artificial (engineered, social, etc.).

I have explored various interfaces of mathematics with the outside world: plasma physics, semiconductor physics and, more recently, collective dynamics in bio or socio dynamics. I have mainly focused on Partial Differential Equations of Kinetic Theory and on other related models (Particle Systems, Hydrodynamic Equations, Diffusion Equations, etc.). I have investigated various mathematical questions such as model derivation, study of qualitative properties of the models, numerical methods, etc.

My research is conducted within research projects involving interdisciplinary collaboration and/or partnerships with industrials or state agencies. The latter have led to consulting appointments (to the French Atomic Energy Commissioner CEA or to the French Aerospace Research Agency ONERA). These projects involve PhD students who are co-advised by young permanent researchers. This provides a stimulating working environment to the students and an opportunity for Junior Researchers to train themselves to student supervision. Among the little more than 40 PhD students that I have advised, about a half have joined the academic career or a state research laboratory. I have entertained many international research collaborations, either through informal relations or through international research grants funded by European or National governments.

My current research projects are mainly concerned with collective dynamics and self-organization in the living and social worlds, through both experimental data analysis and numerical modeling. Such projects are about e.g. spheroid tumor growth, tissue homeostasis, collective dynamics of sperm cells, applications to economics, etc.

### MAJOR RESEARCH ACHIVEMENTS:

We now comment a selection of ten major publications (see list at the end of this section: citation records relative to MathSciNet and ISI Web of Science are provided for these publications but reference numbers are identical to those of the complete publication list).

**Theory of Kinetic Equations.** In [1], with Claude Bardos, we have given the first existence proof for smooth solutions of the Vlasov-Poisson equations in dimension three for small initial data. The Vlasov equation is considered as the master equation for plasma physics and consists of a first-order differential equation in phase-space for the one-particle distribution function. It is coupled nonlinearly to the Poisson equation as charged particles act as sources to the electric forces which control their motion. Previously, only global weak solutions or local strong solutions existed in 3D (results by Horst and Hunze). Later on, in 1992, Pfaffelmoser gave an existence result for global smooth solutions without the smallness condition, but for about ten years, this work gave the best result. The proof relies on an original dispersion estimate for transport equations which has had many other applications. For this reason, this paper has kept a high level of citations. Other works concerning the theory of Kinetic Equations are e.g. [2, 3, 4, 5, 6, 15, 43].

**Particle Methods for Kinetic Equations and Vortex Methods.** Particle methods are among the most widely used numerical methods for kinetic equations, due to the high dimensionality of the problem. They are also very popular in incompressible gas dynamics where they carry the name of vortex methods. Particle methods are very easy to derive for pure convection problems. They basically consist in moving Dirac delta along the characteristics of the equation. By contrast, the treatment of collision terms (in kinetic models) or of diffusion terms (in viscous incompressible fluid dynamics), leads to a significantly increased complexity. In [9], in collaboration with S. Mas-Gallic, we propose a particle treatment of convection-diffusion equations relying first on an approximation of the diffusion by an integral kernel, and second on the approximation of this integral kernel by a modification of the particle weights. This method has had a huge success in fluid dynamics (where it is known as the “Particle Strength Exchange (PSE)” method). The difference in citations between the ISI Web of Sciences and MathSciNet database shows that this method has had a large impact outside mathematics. Other works dealing with particle methods can be found in [7, 10, 11, 12, 23].

**Conforming Finite-Element Methods for Maxwell Equations.** In [26], in collaboration with P. A. Raviart and researchers from the Atomic Energy Commissionner CEA, we have proposed one of the first conforming finite element methods for the time-dependent Maxwell equations. Previous works mainly used either finite difference methods (such as the Yee method) or edge finite element methods of Nédélec type. Our target was to couple the Maxwell equations with a Particle-in-Cell (PIC) discretization of the Vlasov equation in view of modeling vacuum diodes and tubes. Due to these constraints, previous methods were inappropriate: the complex geometry of the problem required unstructured meshes and edge methods generate too rough fields which produce unacceptable noise in particle trajectories. One particularity of the method is to treat the divergence constraints on the fields by means of Lagrange multipliers. This allowed for imperfect satisfaction of the charge continuity equation, a situation often encountered in the context of PIC methods. This work continues to have a large impact, particularly beyond the mathematics community, as the large citation rate on the ISI database indicates. Various developments of this method are given in [40, 45]

**Diffusion Models for Semiconductors.** For a long time, the standard semiconductor model has been the “Drift-Diffusion model”, which describes charged carrier electrical drift and thermal diffusion. But this model is inappropriate for micro and nano devices which operate far from thermodynamical equilibrium. In [38], in collaboration with N. Ben Abdallah, we derive a hierarchy of diffusion models for semiconductors away from equilibrium. This hierarchy encompasses the so-called “Fokker-Planck - Spherical Harmonics Expansion” and the “Energy-Transport” models, which have been extensively used in the semiconductor literature. These models pre-existed to our work but, for the first time, we provide a rigorous ‘dictionary’ which relates the transport coefficients to the underlying microscopic interactions between the particles. The derivation is based on an assumption of scale separation between the various collision phenomena and the application of diffusion approximation techniques. This work has had a large impact and has still a high citation rate. It has been followed by a series of works, either on modeling [34, 54, 56, 62, 66, 72], or on mathematical theory [46, 50, 61, 75], or on numerics [60].

**Quantum Macroscopic Models Derived from the Entropy Principle.** Quantum Kinetic models are based on the Wigner Equation, which is an extension of the classical Vlasov equation. However, simple quantum frameworks describing particle interactions are scarce and complex. For this reason, no general first-principles derivation of Quantum Macroscopic Models existed. In [76], in collaboration with C. Ringhofer, we have used an entropy-based moment closure approach in the spirit of Levermore’s method for the classical case. The moment equations (such as the mass, momentum and energy conservations) are closed by the distribution which realizes the extremum of the quantum entropy subject to the given moment constraints. The difficulty is the non-local character of the quantum entropy (by contrast to the classical case) which results in non-local closure relations. This work has had a big impact, as the high citation rate testifies. It has provided the first ever derivation of quantum macroscopic models based on first principles. Various asymptotic regimes allow to recover previously derived models using heuristic methods. It has had many follow-ups, including [91, 105, 120]. Related quantum transport models can be found in [42, 48, 68, 74, 89].

**Asymptotic-Preserving (AP) Schemes for Plasmas, Low Mach-Number Flows and Strongly Anisotropic Elliptic Problems.** AP schemes have first been introduced by S. Jin. They are schemes for singular perturbation problems which are consistent to the limit problem, in the limit of the small perturbation parameter keeping the discretization parameters fixed. When the perturbation parameter changes locally from order unity to very small, the AP scheme realizes an automatic transition between the perturbation problem and its limit problem. In [106], in collaboration with P. Crispel and M.-H. Vignal, an AP scheme for the Euler-Poisson problem of plasma physics is proposed. The scheme has proved very powerful to describe breakdown of quasineutrality which occurs at plasma edges. AP-schemes have been applied to non-magnetized and magnetized plasmas [125, 133, 140, 149, 152, 154, 157], low Mach-number flows [142, 159] and strongly anisotropic elliptic problems [137, 151, 155]. AP-schemes and the hybrid Kinetic-Fluid coupling strategies of [88, 95, 100, 118, 144, 141, 153] can be combined for optimal efficiency. They provide very efficient numerical methods for kinetic problems at the transition between the purely kinetic and fluid regimes, which is a notoriously difficult problem.

**Fluids with Geometric Exclusion: the Example of Car Traffic.** Geometric exclusion refers to the impossibility of finite-sized particles to interpenetrate each other. It is important in systems exhibiting collective dynamics such as biological tissues, animal groups, vehicular traffic or human crowds. Geometric exclusion generates a phase transition which occurs at a critical “jamming” density between a compressible phase and an incompressible one where particles are in contact with each other. The boundary of the incompressible phase depends on the dynamics itself and cannot be predicted a priori. The study and computation of fluids with geometric exclusion is very challenging. In [122], in collaboration with F. Berthelin, M. Delitala and M. Rascle, we have proposed a general methodology and applied it to a model of car traffic. It consists in using a smooth pressure which blows up near the approach of the jamming density. This work has received significant attention, as the citation rate testifies. This approach has been further developed in [128, 129, 138, 145, 164], notably in the direction of multi-dimensional models. Related problems in the modeling of supply-chains have been treated in [96, 102, 110, 112].

**Self-Organized Hydrodynamics of Active Particle Systems.** Systems of active, or self-propelled particles can be found in nature in animal swarms, bacterial suspensions, sperm, etc. Such particles extract energy from an external source to produce motion. Therefore, their collective motion violates momentum and energy conservations, which poses an outstanding problem to derive macroscopic equations, since conservation is the key concept expressed in macroscopic equations. In [123], with S. Motsch, we have designed a new tool to bypass this problem: the “Generalized Collision Invariant (GCI)”. Thanks to this new concept, we derive the hydrodynamic limit of the Vicsek model describing self-propelled particles interacting through local alignment. The resulting model, the “Self-Organized Hydrodynamics (SOH)” exhibits major differences with classical hydrodynamics: the velocity is constrained to stay of unit norm and Galilean invariance is lost. The SOH models presents a wealth of challenging open problems. This paper has received a high rate of citations since its publication. The concept of GCI has been applied to other active particle models in [127, 147, 165, 167, 170]. It also provides a first-principles derivation of the Landau-Lifchitz-Gilbert equation of micro-magnetism [156].

**Relating Models and Data: Crowd Dynamics.** In [158], we report on experimental and modeling studies of crowd behavior. The goal is to understand how local interactions among individuals give rise to a spontaneous self-organization into lanes. We have studied this phenomenon experimentally and shown that structural instabilities reduce the payoff provided by the traffic segregation. This work has been published in a high impact factor journal. It illustrates what constitutes one of the avenues for applied mathematics in the future years. The tremendous increase of available data will require new methodologies to decipher their complexity. In this quest, mathematicians, aside with statisticians, physicists and computer scientists will play a crucial role. This requires the building of interdisciplinary teams collecting complementary expertise. In companion works, models for crowd behavior have been designed [148, 164, 244] and forthcoming works are devoted to the derivation of macroscopic models inspired from the microscopic model described in [158]. Other traffic systems have been investigated (beyond car traffic as described above), such as ant traffic and the formation of trail networks [161].

**Symmetry-Breaking Phase Transitions.** In the recently published paper [163], we investigate symmetry-breaking phase transitions which occur in polymers, liquid crystals, suspensions of rod-shaped bacterias or self-propelled particles such as insects swarms, etc. In such a transition, the system changes from a state where the particle directions are uniformly distributed (isotropic phase) to a state where almost all particles point in a given direction (directed phase). In [163] we investigate such transitions in the Vicsek model (see above). This is an important problem because the macroscopic properties of the system in the two phases are very different, being of diffusive type in the isotropic phase and of hydrodynamic type in the directed phase, as shown in [163]. In the companion paper, [166], we investigate the order of the phase transition and relate it to the alignment frequency. In the case of first order phase transition, the system exhibits a hysteresis behavior. This paper brings a rigorous perspective to a controversy which has long agitated the physics community about the order of the phase transition appearing in the Vicsek dynamics.

## MAJOR PUBLICATIONS:

Bracketed numbers refer to publication list.

- [1] C. Bardos, P. Degond : *Global existence for the Vlasov-Poisson equation*, Ann. Inst. H. Poincaré Anal. Non Linéaire, 2 (1985), pp. 101-118.
- [9] P. Degond, S. Mas-Gallic, *The weighted particle method for convection-diffusion equations, part 1: the case of an isotropic viscosity*, Math. Comp., 53 (1989), pp. 485-507.
- [26] F. Assous, P. Degond, E. Heintzé, P. A. Raviart, J. Segré, *On a finite-element method for solving the three-dimensional Maxwell equations*, J. Comput. Phys., 109 (1993), pp. 222-237.
- [38] N. Ben Abdallah, P. Degond, *On a hierarchy of macroscopic models for semiconductors*, J. Math. Phys., 37 (1996), pp. 3306-3333.
- [76] P. Degond, C. Ringhofer, *Quantum moment hydrodynamics and the entropy principle*, J. Stat. Phys., 112 (2003), pp. 587-628.
- [106] P. Crispel, P. Degond, M-H. Vignal, *An asymptotic preserving scheme for the two-fluid Euler-Poisson model in the quasineutral limit*, J. Comput. Phys., 223 (2007), pp. 208-234.
- [122] F. Berthelin, P. Degond, M. Delitala, M. Rascle, *A model for the formation and evolution of traffic jams*, Arch. Ration. Mech. Anal., 187 (2008), pp. 185-220.
- [123] P. Degond, S. Motsch, *Continuum limit of self-driven particles with orientation interaction*, Math. Models Methods Appl. Sci., 18, Suppl. (2008), pp. 1193-1215.
- [158] M. Moussaïd, E. G. Guilloit, M. Moreau, J. Fehrenbach, O. Chabiron, S. Lemercier, J. Pettré, C. Appert-Rolland, P. Degond, G. Theraulaz, *Traffic Instabilities in Self-organized Pedestrian Crowds*, PLoS Comput. Biol., 8 (2012), e1002442.
- [163] P. Degond, A. Frouvelle, J-G. Liu, *Macroscopic limits and phase transition in a system of self-propelled particles*, J. Nonlinear Sci., 23 (2013), pp. 427-456.

**CITATION STATISTICS:**

**Publications.** 172 (refereed journals) ; 30 (refereed short notes)

**h-index.** MathSciNet: 22 ; ISI: 26.

**Citation report (ISI Web of knowledge).** See Figure 1 below.

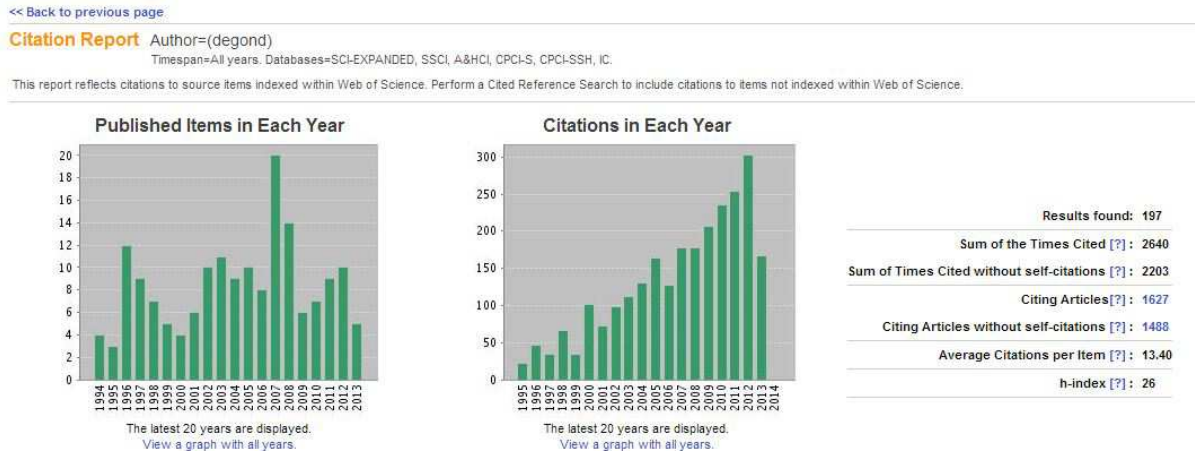


Figure 1: Citations statistics, ISI Web of Science

# Teaching Summary

## Pierre Degond

### SUMMARY OF TEACHING HISTORY AND METHODOLOGY:

I am currently a Chair Professor in Applied Mathematics at Imperial College London. In 2013-2014, I am in charge of the 4-th year (2nd term) undergraduate course M4M8 "Advanced topics in Partial Differential Equations" and I am the tutor of 1st year students.

In spite of having held a research position at CNRS most of my past career, I have been strongly involved in teaching activities through all this period. Additionally, before my current Professor position at Imperial College, I held teaching positions at two occasions: as a part-time Assistant Professor at Ecole Polytechnique (1988-1990) and as a Full Professor at Ecole Normale Supérieure de Cachan (1990-1993).

In the period preceding my appointment at Imperial College, as a counterpart of the Scientific Excellence Premium of CNRS that I had since 2010, I had to perform one third of a teaching duty of a normal French Full Professor at University (i.e. between 40 and 60 hours of classes a year, depending on the proportion of exercise classes). During this period, I have strongly committed myself in the organization of the new Second Year Master, Research Specialization "Fundamental and Applied Mathematics" of Université Paul Sabatier, Toulouse, which has started in fall 2011. Within this curriculum, I have set up a "Math-Bio" Major and have also been involved in the "Partial Differential Equations" Major (teaching the basic course of this Major). I have also a teaching appointment in a nearby engineering school.

I like teaching, especially because of the opportunity of contact with talented young people it provides. I like to challenge them during the class, by asking them their idea of how to perform a proof, or making polls about what should be the right answer. I also like to ask questions of general culture, sometimes beyond mathematics, such as questions about orders of magnitude of physics phenomena. I take particular care in preparing lectures and writing lectures notes, which I make downloadable from my web page. I try to make myself accessible to them, and to lower the generation barrier between us. I do my best to convey the image of mathematics as a hot and exciting topic.

On several occasions, I have taken care of teaching organization. Currently, I am the Chairman of the "Math-Bio" Major of the Second Year Master "Fundamental and Applied Mathematics" of Université Paul Sabatier, Toulouse. I have also held the Chairman position of the Second Year Master of Université Paul Sabatier in the period 2001-2005, and longer ago, that of the Chairman of the Teaching Department at the Ecole Normale Supérieure de Cachan (1991-1993).

### RECENT TEACHING EXPERIENCE:

#### Course Taught within my appointment at Imperial College:

4-th year (2nd term) undergraduate course M4M8 "Advanced topics in Partial Differential Equations" in 2013-2014.

### Course Taught as a Senior CNRS Researcher:

Second Year Master, Research Specialization (5 years after high school graduation), “Fundamental and Applied Mathematics”, Université Paul Sabatier, Toulouse. Basic course “Introduction to Partial Differential Equations” (16.5 hours): *The Laplace, Heat, Wave and Schrödinger equations on the whole space: representation formulas, regularity, decay at infinity of the solutions*. Course taught in 2010-2011, 2011-2012 and 2012-2013

Second Year Master, Research Specialization, “Fundamental and Applied Mathematics”, Université Paul Sabatier, Toulouse. Basic course “Nonlinear hyperbolic equations and systems” (16.5 hours shared with another instructor). *Smooth solutions of the scalar equation by means of characteristics. Finite-time blow-up. Weak solutions. The Rankine-Hugoniot relation. The entropy condition. Kruskov existence and uniqueness theorem (without proof). Notions of systems of conservation laws. Explicit solution of the Riemann problem for the linear wave equation and the P-system of gas dynamics. Notions of numerical discretization*. Course taught in 2011-2012 and 2012-2013

Second Year Master, Research Specialization, “Fundamental and Applied Mathematics”, Université Paul Sabatier, Toulouse. Basic course of the “Math-Bio Major” entitled “Deterministic and stochastic models of complex systems in biology” (16.5 hours). *The three levels of description of particle systems (particle, kinetic, fluid) and examples. Phase transition in fluid models of self-propelled particle systems. The notion of propagation of chaos*. Course taught in 2011-2012 and 2012-2013

Second Year Master, Research Specialization, “Fundamental and Applied Mathematics”, Université Paul Sabatier, Toulouse. Basic course of the “Math-Bio Major” consisting of commented lectures from biologists or article readings (33 hours shared with two other instructors). Course taught in 2012-2013

Third Year at Engineering School “Institut Supérieur de l’Aéronautique et de l’Espace” (5 years after high school graduation), Major of “Complex Systems and Modeling”. Advanced course on “Introduction to the Hierarchical Modeling of Complex Systems” (10 hours). *The three levels of description of particle systems (particle, kinetic, fluid) and examples borrowed from engineering applications*. Course taught in 2012-2013

### Service:

Initiator and Chairman of the “Math-Bio” Major within the Second Year Master (Research Specialization) “Fundamental and Applied Mathematics”, Université Paul Sabatier, Toulouse

### PAST TEACHING EXPERIENCE:

#### Course Taught:

Second Year Master, Research Specialization, “Applied Mathematics”, Université Paul Sabatier, Toulouse. Advanced Course on “Mathematical Modeling of Complex Systems” (28 hours), 2009-2010 & 2010-2011

Second Year Master, Research Specialization, “Applied Mathematics”, Université Paul



Sabatier, Toulouse. Basic Course on “Introduction to Partial Differential Equations” (14 hours), course taught from 2003-2004 to 2006-2007

Second Year Master, Research Specialization, “Applied Mathematics”, Université Paul Sabatier, Toulouse. Advanced Course on “Modeling, Analysis and Numerical Approximation in Kinetic Theory” (14 hours), course taught in 2005-2006 and 2006-2007

Second Year Master, Research Specialization, “Applied Mathematics”, Université Paul Sabatier, Toulouse. Advanced Course on “Mathematical Models in Space Science” (14 hours). Course taught in 2001-2002 and 2002-2003

Second Year Master, Research Specialization, “Applied Mathematics”, Université Paul Sabatier, Toulouse. Advanced Course on “Kinetic models” (14 hours). Course taught in 1997-1998 and 1998-1999

Fifth Year at Engineering School “Institut National des Sciences Appliquées”, Toulouse (5 years after high school graduation), Major of “Mathematical Engineering”. Advanced course on “Transport Phenomena” (10 hours). Course taught from 1995-1996 to 2001-2002

Second Year Master (Research Specialization) “Applied Mathematics”, Université Paul Sabatier, Toulouse. Advanced Course on “Quantum Mechanics and Application to Quantum Chemistry” (14 hours), Course taught in 1994-1995

As a Full Professeur at the “Ecole Normale Supérieure de Cachan”: First and Second Year Master on various aspects of Analysis and Partial Differential Equations. Preparation to the “Agrégation” (certification to be a high-school teacher). A total of about 100 hours of classes per year in the years 1990-1991, 1991-1992 and 1992-1993

Second Year Master, Research Specialization, “Numerical Analysis”, Université Paris 6 on “Kinetic Models of Plasmas” (10 hours). Course taught in 1990-1991

Second Year Master, Research Specialization, “Numerical Analysis”, Université Paris 6 on “Kinetic Models” (10 hours). Course taught in 1989-1990

Part-time Assistant Professor (Maître de Conférences), Ecole Polytechnique, Palaiseau, Exercise classes of the Major of “Numerical Analysis”. *Numerical Analysis of Ordinary Differential Equations and First Order Partial Differential Equations*. Course taught in 1988-1989 and 1989-1990

Second Year Master, Research Specialization, “Numerical Analysis”, Université Paris 6 on “Kinetic Models” (10 hours). Course taught in 1986-1987

First Year of Engineering school “Ecole Nationale des Sciences et Techniques Appliquées (ENSTA)”, Paris (3 years after high school graduation). Exercise classes of the “Numerical Analysis” Course (15 hours), 1983-1984

### Service:

Chairman: Second Year Master, Research Specialization, “Applied Mathematics”, Université Paul Sabatier, Toulouse. 2001-2005

Responsible of the remote teaching project “FICUS: French-Indian Cyber University for Science”, between Université Paul Sabatier, Toulouse and the Indian Institute of Science,

Bangalore. Course taught either in Toulouse or Bangalore were attended remotely through satellite connection. 2000-2002.

Chairman, Teaching Department of Mathematics, Ecole Normale Supérieure de Cachan, academic years 1991-1992 and 1992-1993.

Oral examiner for the Entrance Competition to the Ecole Normale Supérieure de Cachan, 1993.