

Garching, 29 November 2013

Curriculum Vitae

Eric Sonnendrücker

Personal data: born 25 October 1967 in Strasbourg (France),

Professional data: Director of Numerical Methods in Plasma Physics division at Max-Planck-Institute for plasma physics (Garching/Germany).

Professor at Mathematics Department at TU Munich.

Address: Max-Planck-Institut für Plasmaphysik

Boltzmannstr. 2, D-85748 Garching,

Web: <http://www-m16.ma.tum.de>

email: sonnen@ipp.mpg.de - *Tel:* +49 89 3299 2070.

Education

1988–1992: undergraduate studies at Ecole Normale Supérieure de Cachan, major subject mathematics.

1991: Agrégation de mathématiques (teaching degree in mathematics).

1991: Master degree in Numerical Analysis University of Paris-South.

1995: PhD in applied mathematics from Ecole Normale Supérieure de Cachan. Title of dissertation: Mathematical and numerical analysis of the Vlasov-Darwin model (Advisors: P. Degond and P.-A. Raviart).

2000: Habilitation à diriger les recherches from Université Henri Poincaré Nancy. Title of dissertation: Contributions to the mathematical analysis and the numerical simulation of plasmas and particle beams.

Appointments

February 1992 – May 1993: Researcher at Lawrence Livermore National Laboratory, Plasma Physics Research Institute, Livermore (USA).

October 1993 – February 1996: Graduate studies at CEA Limeil-Valenton and Ecole Normale Supérieure de Cachan.

March 1996 – September 1996: Post-doc fellow of Humboldt foundation at Forschungszentrum Karlsruhe (Germany).

October 1996 – August 2000: Chargé de recherche at CNRS at Institut Elie Cartan (UMR 7502, Nancy, France).

September 1998 – August 1999: Post-doc at Lawrence Berkeley National Laboratory, Heavy Ion Fusion group (United States).

September 2000 – August 2012: Professor in applied mathematics at University of Strasbourg.

Since September 2012: Director at Max-Planck Institute for plasma physics and Professor at mathematics department of TU Munich.

Main scientific projects

Since 2012: Head of Numerical Methods in Plasma Physics (NMPP) division at Max-Planck Institute for plasma physics. Member of scientific direction of the Institute.

2003–2012: Head of INRIA project-team Calvi, since its creation in 2003 <http://www.inria.fr/recherche/equipes/calvi.en.html>

2009–2012: Head of INRIA Large scale initiative "modelling and numerical simulation for magnetic fusion and ITER" <http://www.inria.fr/recherche/equipes/fusion.en.html>

Local coordinator of ANR projects (MASSIM (Post-processing of large datasets from numerical simulation, 2005–2008), EGYPT (Gyrokinetic Study of plasma turbulence, 2007–2010), GYPSI (GYrokinetic high Performance Simulation for ITER, 2010–2014). Coordinator of HOUPIC project (High-order Particle In Cell solvers on unstructured grids, 2006–2009).

Coordinator of INRIA research action (2006–2007) on modeling and simulation for magnetic fusion.

French partner of DFG-CNRS project on computational aeroacoustics (german partner: Claus-Dieter Munz, university of Stuttgart).

Research interests

Major research topic numerical analysis and scientific computing aimed in particular at developing simulation tools for plasma and beam physics. Development of several numerical solvers for charged particle simulation, as well Particle In Cell as phase-space grid based methods. Development of multiresolution techniques based on interpolating wavelets for grid based Vlasov solvers. Magnetic fusion applications.

Scientific boards and editorial activities

Member of National Council of Universities (section applied mathematics) (2004–2012). (in charge of qualification of candidates for Maître de Conférence and Professor positions and promotions).

Member of scientific committee of Centre International de Recherche Mathématique at Luminy since (2006–2012).

Member of scientific committee CNRS research group CHANT headed by François Castella (2005–2008).

Head of Center for parallel computing and visualization of the University of Strasbourg (2002–2008).

Member of scientific board for mathematics and computer science of GENCI (french supercomputing coordination), (2008–2012).

Associate editor of book collection Mathématiques et Applications SMAI, Springer France. Associate editor of DSCS-S (Discrete and Continuous Dynamical Systems).

Co-editor with S. Cordier, T. Goudon and M. Gutnic of book *Numerical methods for hyperbolic and kinetic equations*, European Mathematical Society, 2005.

Co-editor with T. Goudon and D. Talay of Volume 15 of ESAIM Proceedings, 2005.

Main invited talks

- Asymptotic and Numerical Methods for kinetic equations, Oberwolfach, 15-21 April 2001.
- CECAM Workshop on open source software for microscopic calculations, Lyon, 19-21 June 2002.

- International Computational Accelerator Physics Conference 2002, Michigan State University, East Lansing, Michigan, USA, 25-28 October 2002.
- ICFA Beam Dynamics Mini Workshop on Space Charge Simulation, Oxford, 2-4 April 2003.
- Workshop VLASOVIA 2003, 26-28 November 2003, Nancy.
- Workshop on Kinetic Theory, Toronto, 29 March - 2 April 2004.
- A-HYKE2 : Around HYperbolic and Kinetic Equations 2, Paris, 14-17 April 2004.
- 15th International Symposium on Heavy Ion Inertial Fusion, Princeton 7-11 June 2004.
- International Computational Accelerator Physics conference, Saint-Petersbourg 29 June - 2 July 2004.
- Congrès franco-canadien de mathématiques, Toulouse 12-15 July 2004.
- Workshop on Wave Phenomena - mathematical modeling and numerical simulation, Hambourg (Germany), 10 et 11 February 2005.
- Particle Accelerator Conference, Knoxville (Tennessee, USA), 16-20 May 2005.
- Heavy Ion Fusion symposium (HIF 06), Saint-Malo, 9-14 July 2006.
- HYP 06 (Lyon), 17-21 July 2006.
- Numerical methods for kinetic equations at the Ecole d'Aquitaine, Maubuisson, 11-14 September 2006.
- Workshop on Computational Electromagnetism and Acoustics at Oberwolfach (February 5-9, 2007).
- Workshop "Méthodes multi-échelles pour la turbulence plasma et fluide: Applications à la fusion dans les plasmas avec confinement magnétique" at CIRM Luminy (April 21-25, 2008).
- ITER workshop at University Paris 6 (May 22-23, 2008).
- France-Canada Conference in Montreal (June 1-5, 2008).
- Lecture at EDF-CEA-INRIA summer school at Nice on the topic "Numerical models for controlled fusion" (September 8-12, 2008).
- Workshop on Gyrokinetic models in Vienna, Austria (September 15-18, 2008).
- Adaptive methods for the Vlasov equation" at "Multiresolution and Adaptive Methods for Convection-Dominated Problems", January 22-23, 2009, Paris, France.
- Adaptive semi-Lagrangian methods for the Vlasov equation, at SMAI 2009 conference, mini-symposium on Multiresolution methods, 25-29 May 2009, La Colle sur Loup, France.

- Geometric formulation of the Vlasov-Maxwell Equations at "Workshop on Hamiltonian methods for ITER physics", 2-6 November 2009, CIRM, Luminy.
- Plasma day at university Paris 6, mars 15, 2010
- Mini-symposium at the SIAM meeting on Dynamical Systems and Partial Differential Equations, Barcelona, May 31-June 4, 2010
- Symposium on new trends in numerical methods for plasma physics, Garching, Germany, July 8, 2010.
- Workshop Frontiers in Computational Astrophysics, ENS Lyon, October 11-15, 2010
- Day on mathematics for energy organized by GdR Momas and CHANT, Paris, November 5, 2010
- Workshop Classical and Quantum Mechanical Models of Many-Particle Systems, Oberwolfach, Germany, December 6-10, 2010.
- i4energy seminar, University of California at Berkeley, March 18, 2011.
- International Conference on the Numerical Simulation of Plasmas, Long Branch (USA), September 6-9, 2011.
- mini-course of 6 hours at ICERM, Brown university (USA), September 12-16, 2011.
- Vlasov Workshop, ICERM, Brown university (USA), September 19-23, 2011.
- NELIA workshop, Santiago de Compostella (Spain), October 25-28, 2011.

Organization of major conferences and summer schools

Organizer of CEMRACS 2003 "Numerical methods for hyperbolic and kinetic problems" with Stéphane Cordier, Thierry Goudon and Michael Gutnic <http://smai.emath.fr/cemracs/cemracs03/>

Organizer of French Numerical Analysis Conference and chair of program committee (2004).

Organizer of CEMRACS 2005 "Computational Aeroacoustics and CFD in Turbulent Flows" with Michael Dumbser, Claus-Dieter Munz and Stèphanie Salmon <http://smai.emath.fr/cemracs/cemracs05/>

Chair of scientific committee of Heavy Ion Fusion International Symposium 2006.

Member of scientific committee of Numerical Models for Controlled Fusion at Porquerolles (2 editions : 2007 and 2009).

Member of scientific committee of SMAI 2009 conference.

Organizer of CEMRACS 2010 "Numerical models for Fusion" with Nicolas Crouseilles, Hervé Guillard and Boniface N'Konga <http://smai.emath.fr/cemracs/cemracs10/>

Coordination of studies

In charge of Master for Pure and applied mathematics (2001-2002)

In charge of "numerical simulation" option of Master Mathematics for industry (2001-2005).

In charge of Master "Scientific Computing and Visualization" (2005-2009).

Supervision of PhD theses

Francis Filbet: Development and analysis of Finite Volume schemes for the Vlasov equation. PhD in mathematics defended in July 2001 at University of Nancy 1. Co-advisor Prof. Said Benachour. Present position: Professor at university Lyon 1.

Nicolas Besse: Development and numerical analysis of semi-Lagrangian methods for the Vlasov equation on unstructured grids. Present position: Associate professor at university Nancy 1. Habilitation 2009.

Michel Mehrenberger: Adaptive numerical methods for the Vlasov equation. PhD in mathematics defended in 2004 at University of Strasbourg. Present position: Associate professor at university of Strasbourg.

Régine Barthelmé: Charge conservation issues in the coupling of Vlasov and Maxwell's equations. PhD in mathematics defended 8 July 2005 in Strasbourg. Present position: Teacher.

Matthieu Haefelé: Simulation and visualization of charged particle beams. Co-advisor Prof. J.-M. Dischler (Visualization). PhD in computer science defended 5 april 2007 in Strasbourg. Present position: Member of code development support team for European Fusion community at Garching, Germany.

Vincent Israel-Jost: Development of numerical image reconstruction method for the small animal in nuclear medicine. Co-advisor Prof. H. Constantinesco (Nuclear medicine). PhD in mathematics defended 16 November 2006 in Strasbourg. Position: graduate student in history and philosophy of sciences at Paris 1.

Sébastien Jund: Development of high-order schemes for aeroacoustics and Maxwell's equations. PhD in mathematics defended 28 november 2007 in Strasbourg. Present position: Teacher.

Alexandre Mouton: Multi-scale numerical methods. Co-advisor Prof. E. Frénod (Vannes). PhD in mathematics defended 16 September 2009. Present position: Research Engineer at CNRS in Lille.

Thomas Respaud: Numerical methods for the Vlasov-Maxwell equations. PhD in mathematics defended 2 November 2010. Present position: Teacher.

Aurore Back: Geometrical methods for the numerical approximation of the Vlasov-Maxwell equations. Defended 7 November 2011. Co-advisor Prof. E. Frénod. Present position: post-doc in Marseille.

Ahmed Ratnani: Isogeometric analysis for the solution of equations of magnetic fusion on complex domains. Defended 7 October 2011. Present position: post-doc at CEA Cadarache

Marc Wolff: Mathematical and numerical analysis of high-order schemes for resistive MHD. Defended 14 October 2011. Co-advisor: Dr. Stéphane Jaouen (CEA Bruyères-Le-Chatel). Present position: industry.

Matthieu Lutz: Mathematical and numerical analysis of a gyrokinetic model including electromagnetic effects. Defended 24 October 2012. Co-advisor Prof. E. Frénod.

Marie Mounier: Discontinuous Galerkin Particle In Cell solvers with adaptive refinement for the Maxwell-Vlasov equations. In her second year. In collaboration with Nuclétudes.

Laura Mendoza: Discontinuous Galerkin Particle In Cell solvers with adaptive refinement for the Maxwell-Vlasov equations. In her first year. In collaboration with Virginie Grandgirard.

Teaching

Taught at least 192 hours per year according to the french higher education system since 2000, including lectures, exercise classes and computer exercises.

Main lectures :

- Adaptive numerical methods for scalar conservation laws
- Modeling and numerical simulation of charged particles
- Kinetic models for fusion
- Numerical methods for the Vlasov-Maxwell equations
- Wavelets. Theory and application to adaptive numerical methods for PDEs.
- High order Finite Element Methods
- Numerical analysis
- Numerical methods for PDEs
- Optimisation