Jeffrey RAUCH

Professor of Mathematics
Department of Mathematics
University of Michigan
Ann Arbor, Michigan 48109-1003
USA

Office:	4834 East Hall
	(734)-936-0003
	(734)-764-0337 (secretary)
Email:	rauch@umich.edu
Home page:	http://www.math.lsa.umich.edu/~rauch
Fax:	(734)-763-0937

BIOGRAPHICAL INFORMATION

Personal

Year of birth:	1945
Family status:	Married, one child

Employment

University of Michigan,

Assistant Professor,	1971-76
Associate Professor,	1976-82
Professor,	1982-
Chairman,	1990-91, 1997-1998
Professor Emeritus,	2015-

Education

Harvard College	A.B., Magna Cum Laude	1967
New York University	Ph.D. (advisor: P.D. Lax)	1971

Visiting Appointments

Institute for Advanced Study, Princeton,
        Member 1976-77, May-Aug. 1978, June-Aug. 1979
Institute des Hautes Études Scientifiques, Paris,   Member 1978-1979
Université de Paris VI,   Visiting Professor, Winter 1979
Université de Paris Nord,   Visiting Professor, May 1979
École Normale Supérieure, Paris,   Visiting Professor, May 1983,
École Polytéchnique,   Maitre de Recherche, Fall 1985
École Normale Supérieure, Paris,   Visiting Professor, Winter 1986
Université de Bordeaux I,   Visiting Professor, June 1987
École Polytéchnique, Palaiseau,   Directeur de Recherche, 1992-1993
École Normale Supérieure, Paris and Université de Paris Sud,   Directeur de Recherche, 1995-1996
École Normale Supérieure, Cachan,   Visiting Professor, May 1997
Nara Women's College, Visitor, September 15-31, 1998
University of Kyoto, Visitor, Oct 1-15, 1998

Université de Rennes I, Professeur Associé, Oct. 15-Nov. 15, 1998
Université de Nice, Professeur Associé, Nov. 15-Dec. 15, 1998
Université de Paris Nord, Professeur Associé, June 2001
Université de Rennes I, Professeur Associé, June 2002
Università di Pisa, Visiting Professsor, Jan. 2003
Université de Nice, Directeur de Recherche, Feb.-Apr. 2003
Centro di Giorgi, Pisa, Feb. 2004
Université de Marseille, Professeur Associé, Mar. 2004
École Polytéchnique, Palaiseau,   Directeur de Recherche, Oct.-Dec. 2004
Università di Pisa, Visiting Professor, Feb-May 2005
Université de Paris Nord, Professeur Invité,   February 2006
École Polytéchnique, Palaiseau,   Directeur de Recherche, Mar. 2006
Università di Pisa, Visiiting Professor, April 2006
Université de Paris Nord, Professeur Invité,   January 2007
Università di Pisa, Visiting Professor, March-April 2007
Institute Henri Poincaré, visitor, January-February 2008
Université de Nice, Professeur Invité, March 2008
Università di Pisa, Professor, April 2008
Ecole Normale Superieure, Paris, Professor Invité Jan. 2009
Université de Paris Nord, Professeur Invité, Feb. 2009
Centro De Giorgi, Pisa, Member Mar., Apr. 2009
Ecole Normale Superieure, Paris, Professor Invité Jan. 2010
Université de Paris Nord, Professeur Invité, Feb. 2010
Università di Pisa/INDAM, Professor, April-May 2010
Université de Paris Nord, Professeur Invité, Jan. 2011
École Polytéchnique, Palaiseau,   Invité, February. 20011
Università di Pisa/GNAMPA, Professor, March 2011
Centro De Giorgi, Pisa, Senior Member April 2011
Fondation de Sciences Mathématique de Paris, Fellow at Ecole Norm. Sup., Jan.-Feb. 2012
Centro De Giorgi, Pisa, Senior Member, March 2012
Università di Pisa/GNAMPA, Professor, April 2012
Ecole Normale Superieure, Paris, Professor Invité Jan. 2013
Université de Paris Nord, Professeur Invité, Feb. 2013
Centro De Giorgi and Laboratorio Fibonacci, Pisa, Senior Member, March-April 2013
Fondation de Sciences Mathématique de Paris, Fellow at University of Paris VII, January 2014
École Polytéchnique, Palaiseau, Professor, February 2014, Jan.-Feb. 2015, Jan.-Feb. 2016,
             Jan.-Feb. 2017, Feb.-Mar. 2018, Mar..-Apr. 2019, 2020
Università di Pisa/INDAM Professor, March, April 2014
Centro De Giorgi and Laboratorio Fibonacci, Pisa, October 2015
Laboratorio Fibonacci, Pisa, April 2017, April 2018
Université Sorbonne Paris Nord, Professeur Invité, Feb. 2020, Feb. 2022

Prizes/Honors

Phi Betta Kappa, Harvard, 1967
Founders Day Award, New York University, 1971
University of Michigan Faculty Recognition Award, 1974
Outstanding Instructor, Michigan Student Assembly, May 1990
Featured Review of *Partial Differential Equations*, Math Reviews,
     MR1223093 (94e:35002) 1992

Excellence in Research Award, University of Michigan, 1996
Review by I. Stewart of my hot spots conjecture, Nature 401(1999), 863 - 865
Starred Review, Math Reviews, MR1682244 (2000i:35115), 2000
Colloque Systèmes hyperboliques et Oscillations, 18-20 May 2006,
       dédié à Jeffrey Rauch, Univeristé de Bordeaux
Chapter 36 of *Théoreme Vivant* by Cédric Villani, Bernard Grasset, Paris, 2011
Starred Review of *Hyperbolic Partial Differential Equations and
       Geometric Optics* , Math Reviews, MR2918544, 2012
Fellow of the American Mathematical Society, 2012
Contemporary Microlocal Analysis in honor of Jeffrey Rauch,
       13-14 April 2017, Univeristé de Monpellier
Starred Review of Strictly dissipative boundary value problems at trihedral corners,
       (with L. Halpern), Math Reviews, MR3790938, 2017
Starred Review of Strictly dissipative nonuniqueness with corners, (with G. Métivier),
       Math Reviews, MR3675556, 2017

Grants

Laboratorio Fibonacci, Pisa, Mar.-Apr.. 2013
Fondation Mathématiques de Paris, Jan.-Feb. 2012
NSF Research Grants 1972–2011
N.A.T.O. Research Grant 1989-1993
NSF-CNRS International Cooperation Grant 1993-1996
Office of Naval Research Grant 1991-1996

Outside Posts

Faculty advisor, University of Michigan sailing team, 1975-76
AMS Committee to Select Regional Conference Speakers, 1984-1987
Editor, Bulletin of the American Mathematical Society, 1989-1992
Board of Governors Institute for Mathematics and its Applications (IMA), 1989-1992
Editor, Proceedings of the American Mathematical Society, 1992-1997
External Review Committee, Dépt. Maths. et Informatique, Ecole Normale Sup., Paris, 1996
AMS Committee on Summer Institutes and Special Meetings, 1997-2000
Editor, Modélisation Mathématique et Analyse Numérique, 1999-2005
Chair, External Evaluation Committee, Centre Math., Ecole Polytéchnique, Paris 2000
Chair, External Review Committee, Dépt. Maths. Univ. de Paris Sud, Orsay June 2000
Commission de récrutement, Ecole Polytéchnique, Paris, 2002-2008.
External Review Committee, Dépt. Maths., Université de Marseille, 2003
Editor, Journal of Hyperbolic Partial Differential Equations, 2002-2008
Chair, External Review Committee, Institut de Mathématiques de Toulouse, February 2006
Editor, Electronic Research Announcements in Mathematical Sciences. 2011-2018
Co-Editor with A. Chorin, Special Volume of *Discreet and Continuous
                Dynamical Systems* for 90th birthday of Peter Lax, 2016
External Review Committee, Laboratoire J.A. Dieudonné, Nice, France, January 2017

Conference Co-organizer/Scientific committee

First Midwest PDE Seminar, University of Michigan, 1975
Conference on Analysis in Honor of L. Cesari, University of Michigan, 1980
IMA Workshop on Microlocal Analysis and Wave Propogation, May 1989
IMA Special Year on Wave Propagation, 1994-95

IMA Workshop on Oscillations and Singularities, April 1995
IMA Workshop on Semiclassical Methods, May 1995
Applications of Analysis to Mathematical Biology, in honor of
                M. Reed, Duke, May 2007
Équations d'evolution non-linéaires dispersives, CIRM Luminy. June 2010
Chocs et Oscillations, in Honor of G. Métivier, Bordeaux Sept. 2010
Nonlinear PDE's and Their Applications to Fluid Dynamics, General Relativity
                and Geometry, in honor of B. Temple, Ann Arbor, May 2011
International Conference on Mathematical and Numerical Aspects of Waves,
                Scientific Committee, 2009, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018.
Shock waves and beyond, June 23-26, 2015, Institute Henri Poincaré, Paris, Scientific committee.

Invited Lecture Series/Minicourses

The Mathematical Theory of Crushed Ice, Tulane University, Spring 1974
Microlocal Analysis and Nonlinear Waves, Ohio State University, April 1980
Nonlinear Geometric Optics, Université de Paris Sud, Fall 1995
Institute for Advanced Study - Park City Summer School on Nonlinear Waves,
                Minicourse on Nonlinear Geometric Optics, Park City, July 1995
Nonlinear Geometric Optics and Conservation Laws, Scandinavian Conference
                on Conservation Laws, Stockholm, Dec. 1997
Symmetric Positive Boundary Value Problems, Nara Women's College, Nara, Sept. 1998
Geometric Optics, Centro diGiorgi, Scuola Normale di Pisa, February 2004
The Cauchy Problem for Hyperbolic PDE, Université de Marseille March 2004
Dispersive Properties of Hyperbolic PDE, Universitá di Pisa. 2006
The Wave Equation and the Laws of Geometric Optics,
                Université de Paris Nord. February 2007, 2008, 2009
Nonlinear Resonance, Università di Pisa. 2007
Encounters with Partial Differential Equations, Ècole Normale Supérieure, Jan. 2009
Encounters with Partial Differential Equations, Università di Pisa. March-April 2010
Encounters with Partial Differential Equations, Université Paris Nord. January-Febrary 2011
Amick Lectures, University of Chicago, Resonance in Wave Progagaion, May 2012
Hörmander's Propagation of Singularities Theorem, Université Paris VII. January 2014
Boundary Value Problems for Partial Differential Equations, Università di Pisa, March-April 2014
Encounters with Partial Differential Equations, Grand Sasso Science Institute. L'Aquila May 2018
Ondes nonlinéaires et analyse multiechelle, Ecole Normale Superieure de Lyon, February 15, 2019
Rays, plane waves, and control, Université Sorbonne Paris Nord, February 2022

Doctoral Students

Maria Schonbek, 1976
Dennis Jesperson, 1976, co-director G. Fix
Parviz Khajeh-Kahlili, 1984
Bryant Russell, 1987
Donald Estep, 1987
Suzanne Brenner, 1988, co-director L. R. Scott
Timothy Wagenmaker, 1994
Philippe Donnat, Ecole Polytéchnique, 1995, co-director P.-A. Raviart
Deborah Alterman, 1999
Jianfeng Liang, 2002

Outside Interests

Bicycling, birding, fishing, cross country skiing, mushrooming

PUBLICATIONS

Books

Partial Differential Equations, Springer-Verlag Graduate Text in Math., Volume 128, 1991.

Microlocal Analysis and Nonlinear Waves, (edited with M. Beals, R. Melrose), IMA Volumes in Mathematics and Its Applications Vol. 30, Springer-Verlag, 1991.

Singularities and Oscillations, (edited with M. Taylor), IMA Volumes in Mathematics and Its Applications Vol. 91, Springer-Verlag, 1997.

Quasiclassical Methods, (edited with B. Simon), IMA Volumes in Mathematics and Its Applications Vol. 95, Springer-Verlag, 1997.

Hyperbolic Partial Differential Equations and Geometric Optics, Graduate Studies in Mathematics vol. 133, American Mathematical Society, 2012, 384 pages.

Book Reviews

Review of *Scattering Theory for the d'Alembert Equation in Exterior Domains* by C. H. Wilcox, Bull. Amer. Math. Soc., **82**(1976), 465-468.

Review of *Basic Linear Partial Differential Equations* by F. Treves, Math. Reviews vol. 56, no. 3, (1978), 834.

Review of *Propagation and Interaction of Singularities in Nonlinear Hyperbolic Problems* by M. Beals, Bull. Amer. Math. Soc. **25**(1991), 157-162.

Review of *Ray Methods for Nonlinear Waves in Fluids and Plasmas*, by A.M. Anile, J.K. Hunter, P. Patano and G. Russo, SIAM Review **37**(1995), 136-137.

Review of *Partial Differential Equations* by L. C. Evans. Bull. Amer. Math. Soc., vol. 37, no.3, (2000), 363-367.

Review of *Wave Motion* by J. Billingham and A.C. King , AMS Monthly, April 2003, pp. 253-258.

Articles

1971

Energy Inequalities for Hyperbolic Initial Boundary Value Problems, Ph.D. Thesis, New York University.

Kreiss' mixed problems with nonzero initial data, Bull. Amer. Math. Soc.,**77**, 1031-1033.

1972

L^2 is a continuable initial condition for Kreiss' mixed problems, Comm. Pure Appl. Math., **25**, 265-285.

Penetrations into shadow regions and unique continuation properties in hyperbolic mixed problems, (with M. Taylor), Indiana U. Math. J., **22**, 277-285.

Energy and resolvent inequalities for hyperbolic mixed problems, Jour. Differential Equations, **11**, 528-540.

1973

Two examples illustrating the differences between classical and quantum mechanics, (with M. Reed), Comm. Math. Phys., **29**, 105-111.

Essential self-adjointness of powers of generators of hyperbolic mixed problems, (with M. Taylor), J. Funct. Anal., **12**, 491-493.

General theory of hyperbolic mixed problems, Amer. Math. Soc. Proc. Symp. Pure Appl. Math., **23**, 161-166.

1974

Differentiability of solutions to hyperbolic initial-boundary value problems, (with F. Massey), Trans. Amer. Math. Soc., **189**, 303-318.

Exponential decay of solutions to hyperbolic equations in bounded domains, (with M. Taylor), Indiana Univ. Math. J., **24**, 79-86.

An inclusion theorem for ovaloids with comparable second fundamental forms, J. Differential Geom., **9**, 501-505.

1975

Potential and scattering theory on wildly perturbed domains, (with M. Taylor), J. Funct. Anal., **18**, 27-59.

Decay of solutions to nondissipative hyperbolic systems on compact manifolds, (with M. Taylor), Comm. Pure Appl. Math., XXVIII, 501-523.

Electrostatic screening, (with M. Taylor), J. Math. Phys., **16**, 284-288.

Smoothness of decaying wave motions, (with M. Taylor), Proc. Amer. Math. Soc., **49**, 334-338.

Five problems: An introduction to the qualitative theory of partial differential equations, in *Partial Differential Equations and Related Topics*, Springer Lecture Notes in Mathematics, **446**, 355-369.

The mathematical theory of crushed ice, in *Partial Differential Equations and Related Topics*, Springer Lecture Notes in Mathematics, **446**, 370-379.

Scattering by many tiny obstacles, in *Partial Differential Equations and Related Topics*, Springer Lecture Notes in Mathematics, **446**, 380-389.

1976

Global solvability of the Casimir operator, (with D. W. Wigner), Annals of Math., **103**, 229-236.

Qualitative behavior of dissipative wave equations on bounded domains, Arch. Rational Mech. Anal., **62**, 77-85.

Decaying states of perturbed wave equations, (with M. Taylor), J. Math. Anal. Appl., **54**, 279-285.

Global existence for the FitzHugh-Nagumo equations, Comm. Partial Differential Equations, **1**, 609-621.

1977

The leading wavefront for hyperbolic mixed problems, Bull. Soc. Royale des Sciences de Liege, **46**, 156-161.

The Dirichlet problem for the multidimensional Monge-Ampère equation, (with B. A. Taylor), Rocky Mountain J. Math., **7**, 345-364.

Discontinuous semilinear differential equations and multiple valued maps, Proc. Amer. Math. Soc., **64**, 277-282.

Stability of motion for semilinear equations, in *Boundary Value Problems for Linear Evolution Partial Differential Equations*, H. G. Garnir, ed., D. Reidel Publ. Co., Dordecht-Holland, 319-349.

1978

Asymptotic behavior of solutions to hyperbolic partial differential equations with zero speeds,

Comm. Pure Appl. Math., XXXI, 431-480.

Local decay of scattering solutions to Schrödinger's equation, Comm. Math. Phys., **61**, 149-168.

Qualitative theory of the FitzHugh-Nagumo equations, (with J. A. Smoller), Advances in Math., **27**, 12-44.

Strongly nonlinear perturbations of nonnegative boundary value problems with kernel, (with P. J. McKenna), J. Differential Equations, **28**, 253-265.

Illumination of bounded domains, Amer. Math. Monthly, **85**, 359-361.

Euclidean nonlinear classical field equations with unique vacuum, (with D. N. Williams), Comm. Math. Phys., **63**, 13-29.

1979

Singularities of solutions to semilinear wave equations, J. Math. Pures et Appliquées., **58**, 299-308.

Boundary value problems as limits of problems in all space, Seminaire Goulauic-Schwartz, École Polytéchnique, III-1 to III-17.

Propagation des singularités pour les équations des ondes semi- linéares, Journées Équations aux Dérivées Partielles, St. Cast, École Polytéchnique Publ., 2 pp.

Topics on Euclidean classical field equations with unique vacuua, (with D. N. Williams), in *Proc. International Colloq. on Feynman Path Integrals*, Marseille 1978, Springer-Verlag, Heidelberg, 189-202.

1980

Propagation of singularities for semilinear hyperbolic equations in one space variable, (with M. Reed), Annals of Math., **111**, 531-552.

Perturbation theory for eigenvalues and resonances of Schrödinger hamiltonians, J. Funct. Anal., **35**, 304-315.

1981

Propagation of analytic singularities along diffracted rays, (with J. Sjöstrand), Indiana U. Math. J., **30**, 389-401.

I. The u^5 Klein-Gordon equation. II. Anomalous singularities for semilinear wave equations, in *Nonlinear Partial Differential Equations and Their Applications*, H. Brezis and J. L. Lions, eds., Collège de France Seminar, Pitman Publ., 335-364.

Jump discontinuities of semilinear, strictly hyperbolic systems in two variables: creation and propagation, (with M. Reed), Comm. Math. Phys., **81**, 203-227.

1982

Nonlinear microlocal analysis of semilinear hyperbolic systems in one space dimension, (with M. Reed), Duke Math. J., **49**, 397-475.

Maximal positive boundary value problems as limits of singular perturbation problems, (with C. Bardos), Trans. Amer. Math. Soc., **270**, 377-408.

Singularities produced by the nonlinear interaction of three progressing waves: examples, (with M. Reed), Comm. Partial Differtial Equations, **7**, 1-17.

A model for harmonics on stringed instruments, (with A. Bamberger and M. Taylor), Arch. Rational Mech. Anal., **79**, 267-290.

Propagation of singularities in non-strictly hyperbolic semilinear systems: examples, (with M. Reed), Comm. Pure Appl. Math., **XXXV**, 555-565.

A general regularity theorem for semilinear hyperbolic waves in one space dimension, (with M. Reed), Bull. Amer. Math. Soc.,**6**, 445-448.

Singularities of solutions of semilinear wave equations, in *Proc. International Conference on Physics, Berlin 1981*, Springer Lecture Notes in Physics, Springer-Verlag, Berlin.

<div align="center">1983</div>

An L^2 proof that H^s is invariant under nonlinear maps, in *Global Analysis, Analysis on Manifolds*, T. M. Rassias ed., B. G. Teubner Publ., Leipzig, 301-305.

<div align="center">1984</div>

Raylike solutions of semilinear wave equations, (with M. Reed), in *Microlocal Analysis*, M. S. Baouendi, R. Beals, and L. P. Rothschild, eds., Contemp. Math., **27**, 107-117.

<div align="center">1985</div>

Symmetric positive systems with boundary characteristic of constant multiplicity, Trans. Amer. Math. Soc., **291**, 167-187.

Striated solutions of semilinear two speed wave equations, (with M. Reed), Indiana U. Math. J., **34**, 337-353.

Convergence of the finite element method for the wave equation, SIAM J. Numer. Anal., 245-250.

Discontinuous progressing waves for semilinear wave equations, (with M. Reed), Comm. Partial Differential Equations, **10**, 1033-1075.

<div align="center">1986</div>

BV estimates fail for most quasilinear hyperbolic systems in dimensions greater than one, Comm. Math. Phys., **106**, 484-489.

Classical, conormal, semilinear waves, (with M. Reed), Seminaire Équations aux Dérivées Partielles 1985-86, École Polytéchnique V-1 to V-7.

Ondes oscillantes semi-linéaires en 1.d, (with J. L. Joly), Journées Équations aux Dérivées Partielles, St. Jean de Monts, June 1986, Publ. de l'École Polytéchnique, 20p.

Pôles de la diffusion acoustique et singularités Gevrey 3, (with C. Bardos, and G. Lebeau), Séminaire de Théorie Spectrale et Géomtrie, No. 4, Année 1985- 1986, Univ. Grenoble I, Saint-Martin-d'Hres, 127-130.

<div align="center">1987</div>

Scattering frequencies and Gevrey 3 singularities, (with C. Bardos and G. Lebeau), Invent. Math., **90**, 77-115.

Nonlinear superposition and absorption of delta waves in one space dimension, (with M. Reed), J. Funct. Anal., **73**, 152-178.

Propagation de la régularité locale de solutions d'équations hyperboliques nonlinéaires, (with P. Gerard), Ann. Inst. Fourier, **37**, 65-85.

Error analysis for absorbing boundary conditions, (with L. Halpern), Numerische Math., **51**, 459-467.

High frequency semilinear oscillations, (with J. L. Joly), in *Wave Motion: Theory, Modelling, and Computation*, A. J. Chorin and A. J. Majda, eds., Springer-Verlag, 202-217.

On the absorption of singularities in dissipative nonlinear equations, (with M. Reed), in *Differential Equations and Mathematical Physics*, I. W. Knowles and Y. Saito, eds., Springer Lecture Notes in Mathematics, **1285**, 403-407.

Superposition d'ondes singuliéres, (with F. Demengel), C. R. Acad. Sci. Paris, t. 304, Sér. I, 447-449.

Continuité faible des fonctions de mesures (non convexes), (with F. Demengel), C. R. Acad. Sci. Paris, t. 305, Sér. I. 63-66.

Controle et stabilisation pour l'équation des ondes, (with C. Bardos and G. Lebeau), Colloque St. Jean de Monts, June 1987, Publ. de l'École Polytéchnique, Palaiseau.

Ultrasingularities in nonlinear waves, (with M. Reed), in *Nonlinear Semigroups, Partial Differential Equations, and Attractors*, T. Gill and W. Zachary eds., Springer Lecture Notes in Mathematics no. **1248**, 134-141.

1988

Classical conormal solutions of semilinear systems, (with M. Reed), Comm. Partial Differential Equations, **13**, 1297-1335.

Explosions for some semilinear wave equations, J. Differential Equations, **74**, 29-33.

Controle et stabilisation dans les problèmes hyperboliques, (with C. Bardos and G. Lebeau), appendix to *Controlabilité Éxacte de Systemes Distribués Vol. I*, J. L. Lions, RMA Collection No. 8, Masson, Paris.

Ondes oscillantes semi-linéaires à hautes fréquences, (with J. L. Joly), in *Recent Developments in Hyperbolic Equations*, L. Cattabriga, F. Colombini, M. Murthy, S. Spaonolo, eds., Pitman Research Notes in Math., **183**, 103-115.

1989

Bounded, stratified, and striated solutions of hyperbolic systems, (with M. Reed), in *Nonlinear Partial Differential Equations and Their Applications Vol. IX*, H. Brezis and J. L. Lions, eds., Pitman Research Notes in Math., **181**, 334-351.

The interaction of two progressing waves, (with G. Métivier), in *Nonlinear Hyperbolic Problems*, C. Carasso, P. Charrier, B. Hanouzet, and J. L. Joly, eds., Springer Lecture Notes in Math., **1402**, 216-227.

Un exemple d'utilisation des notions de propagation pour le controle et la stabilisation des problèmes hyperboliques, (with C. Bardos and G. Lebeau), Rend. Sem. Mat. Univ. Politec. Torino, 1988, 11-32.

Microlocal ideas in control and stabilization, (with C. Bardos and G. Lebeau), in *Control of Boundaries and Stabilization*, F. Le Dimet and J. Simon, eds., Springer Lecture Notes in Control & Information Sci., **125**, 14-30.

1990

Interaction of piecewise smooth progressing waves for semilinear hyperbolic equations, (with G. Métivier), Comm. Partial Diff. Equations **15**, 1079-1140.

Boundedness of dispersive difference schemes, (with D. Estep and M. Loss), Mathematics of Computation **55**, 55-87.

Weak convergence of asymptotically homogeneous functions of measures, (with F. Demengel), J. Nonlinear Analysis **15**, 1-16.

Measure valued solutions of asymptotically homogeneous semilinear hyperbolic systems in one space variable, (with F. Demengel), Proc. Edinburgh Math. Soc. 33 Series II, 443-460.

Remarques sur l'optique non linéaire multidimensionelle, (with G. Métivier and J.L. Joly), Seminaire Équations aux Dérivées Partielles, École Polytéchnique, Palaiseau, I-1 to I-17.

Rigorous resonant $1 - d$ nonlinear geometric optics, Journées Équations aux Dérivées Partielles,

St. Jean de Monts, École Polytéchnique Palaiseau Publ., VII-1 to VII-12.

1991

Nonlinear resonance can create dense oscillations, (with J. L. Joly) in *Microlocal Analysis and Nonlinear Waves*, M. Beals, R. Melrose, J. Rauch, eds., Springer-Verlag, Volume 30, 113-124, .

Stabilisation de l'équation des ondes au moyen d'un feedback portant sur la condition aux limites de Dirichlet, (with C. Bardos, L. Halpern, G. Lebeau, E. Zuazua), Asymptotic Analysis, **4**, 285-291.

Control and stabilization for Hyperbolic Equations, (with C. Bardos and G. Lebeau), in *Mathematical and Numerical Aspects of Wave Propagation Phenomena*, G. Cohen, L. Halpern and P. Joly eds., SIAM Publications, 252-266.

1992

Sharp sufficient conditions for the observation, control and stabilization of waves from the boundary, (with C. Bardos and G. Lebeau), SIAM J. Control Optim. 30 **5**, 1024-1065.

Justification of multidimensional single phase semilinear geometrical optics, (with J.L. Joly), Trans. Amer. Math. Soc., **330**, 599-625.

Controllabilité exacte, homogénéisation et localisation d'ondes dans un milieu non-homogéne, (with M. Avellaneda and C. Bardos), J. Asymptotic Analysis **5**, 481-494.

Formal and rigorous nonlinear high frequency hyperbolic waves, (with J.L. Joly and G. Métivier), in *Nonlinear Hyperbolic Waves and Field Theory*, M.K. Murthy & S. Spagnolo eds., Pitman Research Notes in Math no. **253**, 121-143.

1993

Resonant one dimensional nonlinear geometric optics, (with J.L. Joly and G. Métivier), J. Functional Analysis, Vol. **114**, No. 1, 106-231.

Generic rigorous asymptotic expansions for weakly nonlinear multidimensional oscillatory waves, (with J.L. Joly and G. Métivier), Duke Math J., **70**, 373-404.

Blow-up of test fields near Cauchy horizons, (with A. Rendall), Lett. Math. Phys., **29**, 241-248.

On the profiles of nonlinear geometric optics, (with J.L. Joly and G. Métivier), Seminaire Équations aux Derivées Partielles 1992-93, École Polytéchnique, I-1 to I-14.

Focussing and Absorbtion of Nonlinear Oscillations, (with J.L. Joly and G. Métivier), Journées aux Dérivées Partielles, St. Jean de Monts, École Polytéchnique Publ., III-1 to III-11.

1994

A nonlinear instability for 3x3 systems of conservation laws, (with J.L. Joly and G. Métivier), Comm. Math. Phys. **162**, 47-59.

Coherent nonlinear waves and the Wiener algebra, (with J.L. Joly and G. Métivier), Annales de L'Institut Fourier, **44**, 167-196.

Variational algorithms for the Helmholz equation using time evolution and absorbing boundaries, (with C. Bardos), J. Asympt. Anal, **9**, 101-117.

Boundary value problems with nonuniformly characteristic boundary, J. Maths. Pures et Appliquées **73**, 347-353.

Scattering for a one-sided Klein-Gordon equation in quantum gravity, (with J.P. Dias and M. Figuera), Ann. Inst. Henri Poincaré, Physique Théorique, **64**, 75-86.

Compacité par compensation trilinéare et optique géométrique nonlinéare, (with J.L. Joly and G. Metivier), Seminaire Équations aux Dérivées Partielles 1993-1994, École Polytéchnique, III-1 to III-44.

1995

Coherent and focusing multidimensional nonlinear geometric optics, (with J.L. Joly and G. Métivier), Annales de L'École Normale Supérieur, **28**, 59-113.

Trilinear compensated compactness and nonlinear geometric optics, (with J.L. Joly and G. Métivier), Annals of Math **142**, 121-169.

Absorbing boundary conditions for diffusion equations, (with L. Halpern), Numerische. Math. **71**, 185-224.

Focusing at a point and absorbtion of nonlinear oscillations, (with J.L. Joly and G. Métivier), Trans. AMS. **347**, 3921-3969.

1996

Nonlinear oscillations beyond caustics, (with J.L. Joly and G. Métivier), Comm. Pure Appl. Math. **XLIX**, 443-527.

Global solvability of the anharmonic oscillator model from nonlinear optics, (with J.L. Joly and G. Métivier), SIAM J. Math. Anal, **27**, 905-913.

Global solvability of the Maxwell-Bloch model in nonlinear optics, (with P. Donnat), Archives for Rational Mechanics and Analysis, **136**, 291-303.

Diffractive nonlinear geometric optics, (with P. Donnat, J.L. Joly and G. Métivier), Seminaire Équations aux Derivées Partielles 1995-96, École Polytéchnique, XVII-1 to XVII-23.

Dense oscillations for the Euler equation II, (with J.L. Joly and G. Métivier) in *Hyperbolic Problems: Theory Numerics, Applications*, J. Glimm, M.J. Graham, J.W. Grove, B.J. Plohr eds., World Scientific Publ. 1996, 425-430.

Several recent results in nonlinear geometric optics, (with J.L. Joly and G. Métivier) in *Partial Differential Equations and Mathematical Physics*, L. Hörmander and A. Melin eds., Birkhäuser Publ. 181-207.

Quelque résultats recents en optique non linéaire, (with J.-L. Joly and G. Métivier), in *Complex Analysis, Harmonic Analysis, and Applications*, eds. R. Deville, J. Esterle, V. Petkov, A Sebbar, A. Yger, Pitman Research Notes in Math. **347**, 183-207

1997

Dispersive nonlinear geometric optics, (with P. Donnat), Jour. Math. Physics, **38**(3), 1484-1523.

Caustics for dissipative semilinear oscillations, (with J.-L. Joly and G. Métivier), in *Geometric Optics and Related Topics*, eds. F. Colombini and N. Lerner, Birkhäuser Publ., Boston.

Estimations L^p d'Intégrales Oscillantes, (with J.-L. Joly and G. Métivier), Seminaire Équations aux Derivées Partielles 1996-97, École Polytéchnique, VII-1 to VII-15.

Modelling the dispersion of light, (with P. Donnat), in *Singularities and Oscillations*, (eds J. Rauch and M. Taylor), IMA Volumes in Mathematics and Its Applications Vol. **91**, Springer-Verlag, 17-36.

Nonlinear Oscillations and Caustics, (with J.-L. Joly and G. Métivier), in *Singularities and Oscillations*, (eds J. Rauch and M. Taylor), IMA Volumes in Mathematics and Its Applications Vol. **91**, Springer-Verlag, 17-36.

Caustics for dissipative semilinear oscillations, (with J.-L. Joly and G. Métivier), in *Geometric Optics and Related Topics*, F. Colombini and N. Lerner eds., Birhäuser, Boston 1997, 245-266.

1998

Diffractive nonlinear geometric optics with rectification, (with J.-L. Joly and G. Métivier), Indiana

U. Math. J. **47**, 1167-1242.

Solutions globales du système de Maxwell dans un milieu ferromagnétique, (with J.-L. Joly and G. Métivier), Seminaire Équations aux Derivées Partielles 1997-98, École Polytéchnique.

Dense oscillations for the compressible two dimensional Euler equations, (with J.L. Joly and G. Métivier), in *Nonlinear Partial Differential Equations and their Applications Collège de France Seminar vol XIII*, D. Cioranescu and J.L. Lions eds., Pitman Research Notes in Math Series no. 391, pp. 134-166.

Propagation des ondes électomagnétique en présence d'un materiau ferromagnétique, (with J.-L. Joly and G. Métivier), Actes du 29me Congrs d'Analyse Numrique: CANum'97 (Larnas, 1997), ESAIM Proc., 3, Soc. Math. Appl. Indust., Paris, pp. 85-99, http://www.emath.fr/proc/Vol.X/.

1999

Nonlinear hyperbolic smoothing at a focal point, (with J.-L. Joly and G. Métivier), Michigan Math. J., 295-312.

Diffractive short pulse asymptotics for wave equations, (with D. Alterman), Physics Letters A **264**(5), 390-395.

Nonlinear hyperbolic smoothing at a focal point, (with J.-L. Joly and G. Métivier), Seminaire Équations aux Derivées Partielles 1998-99, École Polytéchnique, V-1-V-11.

Lectures on Geometric Optics, in *Hyperbolic Equations and Frequency Interactions* eds. Luis Caffarelli and Weinan E., IAS/Park City Mathematics Series, Volume V, AMS, 1999, 383-466.

Recent results in non-linear geometric optics (with J.-L. Joly and G. Métivier), in *Hyperbolic problems: theory, numerics, applications, Vol. II*, pp. 723–736, Internat. Ser. Numer. Math., 130, Birkhuser, Basel, 1999.

Optique géometrique non linéaire et équations de Maxwell-Bloch, (with J.-L. Joly and G. Métivier), Seminaire Équations aux Derivées Partielles 1998-99, École Polytéchnique

2000

Transparent Nonlinear Geometric Optics and Maxwell-Bloch Equations, (with J.-L. Joly and G. Métivier), J. Diff. Eq. **166**, 175-250.

Caustics for dissipative semilinear oscillations, (with J.-L. Joly and G. Métivier), Memoires AMS #685, 72 pages.

Global solutions to Maxwell's equations in a ferromagnetic medium, (with J.-L. Joly and G. Métivier), Ann. Institute Henri Poincaré, Physique Théorique, **1**307-340.

Diffractive short pulse asymptotics for nonlinear wave equations, (with D. Alterman), Phys. Lett. A, **264**, no. 5, 390–395.

Linear Diffractive Pulse Equation, (with D. Alterman), Methods and Appl. of Anal. **7**, 263-274.

2001

Validity of nonlinear geometric optics with times growing logarithmically, (with D. Lannes), Proc. AMS, **129**, 1087-1096.

Resonant geometric optics and webs, (with J.-L. Joly and G. Métivier), in *Web Theory and Related Topics* eds. J. Grifone and E. Salem, 114-132, World Scientific Publ.

Absorption d'impulsions non-linéaires radiales focalisantes dans $\mathbf{R}^{1+3}$ (with R. Carles), C. R. Acad. Sci. Paris, t.332, Série I, 985-990.

Diffusions d'impulsions non-linéaires radiales focalisantes dans $\mathbf{R}^{1+3}$ (with R. Carles), C. R. Acad. Sci. Paris, t. 332, Serie I, p. 1077-1082.

Correcting the failure of the slowly varying amplitude approximation for short pulses, (with D. Alterman), Ultrafast Phenomena XII eds. T. Elsaesser, S. Mukamel, M.M. Murnane, N.F. Scherer, Springer, 71-73.

Nonlinear pulse propation, article XI in *Journées Équations aux Dérivées Parielles, Plestin-les Grèves,* juin 2001, www.math.sciences.univ-nantes.fr/edpa.

2002

Focusing of spherical nonlinear pulses in $\mathbf{R}^{1+d}$, (with R. Carles), Proc. Amer. Math. Soc. **130** no. 3, 791-804.

Nonlinear geometric optics for short pulses, (with D. Alterman), Journal of Differential Equations **178**, 437-465.

2003

Diffractive nonlinear geometric optics for short pulses, (with D. Alterman), SIAM J. Math. Anal **34**, 1477-1502.

Real and Complex Regularity are Equivalent for Hyperbolic Characteristic Varieties, (with G. Métivier), Differential Integral Equations, **16**, 993–999.

Group velocity at smooth points of hyperbolic characteristic varieties, in *Autour de L'Analyse Microlocale*, Astérix **284**, 265-269.

Unicity and nonunicity for nonsmooth divergence free transport, (with F. Colombini and T. Luo), Séminaire Équations aux Dérivées Partielles 2002-2003, XXII pp. 1-21, Ecole Polytéchnique, Paris

2004

Intuitive and counterintuitive energy flow, Archive Rational Mechanics and Anal. **174**, 83-110.

Focussing of spherical nonlinear pulses in $\mathbf{R}^{1+3}$, II. Nonlinear Caustic, (with R. Carles), Revista Matematica Iberoamericana, 815–864.

Focussing of spherical nonlinear pulses in $\mathbf{R}^{1+3}$, III. Sub and Supercritial cases, (with R. Carles), Tohoku Math. J., 393–410.

Nearly lipshitzean divergence free transport propagetes neither continuity nor BV, (with F. Colombini and T. Luo), Comm. Math. Sci. **2**, 162-167.

2005

Hyperbolic domains of determination and Hamilton-Jacobi equations, (with J.-L. Joly and G. Métivier), Journal of Hyperbolic Partial Differential Equations **2**, 713-744.

Time integrated far field for Maxwell's and D'Alembert's equations, (with G. Mourou) Proc. Amer. Math. Soc. **134**, 851-858.

Polynomial decay for a hyperbolic-parabolic coupled system (with Xu Zhang and E. Zuazua), J. Math. Pures et Appl. **9**, 407-470.

Regularity of functions smooth along foliations, and elliptic regularity, (with M. Taylor), Journal of Functional Analysis **225**, 74-93.

Precise finite speed with bare hands, Methods Appl. Anal. **12**, 267-277.

Uniqueness in the Cauchy problem for tranport in dims $\mathbf{R}^2$ and $\mathbf{R}^{1+2}$, (with F. Colombini), J. Diff. Eq. **211**, 162-167. Corrigendum to: "Uniqueness in the Cauchy problem for transport in $\mathbf{R}^2$ and $\mathbf{R}^{1+2}$" J. Differential Equations 211 (2005), no. 1, 162–167, J. Differential Equations 216 (2005), **1**, 259.

Sharp domains of determination and Hamilton-Jacobi equations, Seminaire équations aux dériv'ees partielles, Ecole Polytéchnique, 2004-2005.

2006

Nonlinear asymptotics for hyperbolic internal waves of small width, (with O. Gues), J. Hyperbolic Diff. Equ. **3**, 269–295.

Hyperbolic L^p multipliers are translations, (with O. Gues), Comm. Partial Differential Equations **31**, 431–443.

A note on two dimensional transport with bounded divergence, (with F. Colombini and G. Crippa), Comm. P.D.E **31**, 1109-1115.

A transmission strategy for hyperbolic internal waves, (with O. Gues), Séminaire Equations aux Dérivées Partielles, Ecole Polytéchnique, 2005-2006, exposé XIII.

2007

Á Travers un Prism, in *Lecons de Mathématiques d'Aujourd'hui* vol III, eds E. Charpentier and N. Nikolski, Cassini Pubs., Paris, pp. 35-68.

2008

Smooth localized parametric resonance for wave equations (with F. Colombini), J. Reine Angew. Math. **616**, 1-14.

A simple example of parametric resonance for the wave equation, (with F. Colombini), Serdica Mathematics Journal, **34**, 55-66.

2009

Exponential growth for the wave equation with compact time-periodic positive potential, (with F. Colombini and V. Petkov), Communications in Pure and Applied Mathematics (**62**) 565-582.

Diffractive behavior of the wave equation in periodic media: weak convergence analysis, (with G. Allaire and Mariapia Palombaro), Ann. Mat. Pura Appl. (**4**) 561-589.

The Order of Accuracy of Quadrature Formulae for Periodic Functions, (with A. Kurganov), in *Phase Space Analysis of Partial Differential Equations*, eds. A. Bove, D. Del Santo, M.K.V. Murthy, Progress in Nonlinear Differential Equations and their Applications vol.78, Birkhauser, 2009

2010

Dispersive stabilization (with G. Métivier), Bull. Lond. Math. Soc. **42** , no. 2, 250–262.

Hyperbolic systems modeling currency hoarding (with E. Quercioli), Commun. Math. Anal. **8** 70-91.

Quadrature estimates for multiple integrals, (with M. Taylor), Houston Journal of Mathematics **36** 727-749.

2011

The analysis of matched layers (with L. Halpern, and S. Petit-Bergez), Confluentes Math. **3** no. 2, 159–236.

Stability of transonic shock solutions for one dimensional Euler-Poiosson equations (with T. Luo, C. Xie, and Z. Xin), Archive Rational Mechanics and Analysis. **202**, no. 3, 787-827.

Diffractive geometric optics for Bloch wave packets, with G. Allaire and M. Palombaro, Archive Rational Mechanics and Analysis, **202**, 373-426.

Precise finite speed and uniqueness in the Cauchy problem for symmetrizable hyperbolic systems, Trans. Amer. Math. Soc. **363** no. 3, 1161-1182.

Optimal focussing for monochromatic scalar and electromagnetic waves, Reviews in Mathematical Physics **23** no. 8, 839–863.

Invariance and stability of the profile equations of geometric optics, with G. Métivier, Acta Mathematica Scientia 2011, **31** B(6), 2141-2158.

Sharp finite speed for hyperbolic problems well posed in Gevrey classes, (with F. Colombini), Comm. Partial Differential Equations **36** no. 1, 1–9.

Incoming and disappearing solutions for Maxwell's equations, (with F. Colombini and V. Petkov), Proc. Amer. Math. Soc. **139** no. 6, 2163–2173.

C^1 BV preserving diffeomorphisms must be Lipshitzean, (with F. Colombini and T. Luo), Math Anal. and Applications. **18**, No. 2. 159-164.

Perfectly Matched Layers for Acoustic Waves in 3D Heterogeneous Media (with Ludovic Metivier and Laurence Halpern), Proceedings of the 10th International Conference on the Mathematical and Numerical Aspects of Waves, Pacific Institute for the Mathematical Sciences, 580-590.

Conservation laws and fold caustics in the high frequency regime. 295-298 (with Olivier Lafitte and Youness Noumir), Proceedings of the 10th International Conference on the Mathematical and Numerical Aspects of Waves, Pacific Institute for the Mathematical Sciences, 295-298.

2012

Global in time stability of steady shocks in nozzles, (with C. Xie and Z. Xin), Séminaire Laurent Schwartz, École Polytéchnique, 2010-2011.

2013

Diffraction of Bloch wave packets for Maxwell's equations, (with G. Allaire and M. Palombaro), Comm. Contemp. Math. **15** 135040, 36 pages.

Global stability of steady transonic Euler shocks in quasi-one-dimensional nozzles, (with C. Xie and Z. Xin), J. Math. Pures Appl. (9) 99, no. 4, 395-408.

Bérenger/Maxwell with Discontinous Absorptions: Existence, Perfection, and No Loss, Séminaire Laurent Schwartz, École Polytéchnique, 2012-2013.

2014

Water Wave Propagation in Unbounded Domains. Part I: Numerical Methods for Fractional PDEs Part I, (with G. Izbicki, S. Karni), J. Comput. Phys. **276**, 729-739.

Water Wave Propagation in Unbounded Domains. Part II: Numerical Methods for Fractional PDEs Part II, (with G. Izbicki, S. Karni, D.Prigge, S. Carney, R. Abgrall), J. Comput. Phys. **275**, 443-458.

Spectral problems for non-elliptic symmetric systems with dissipative boundary conditions, (with F. Colombini and V. Petkov), J. Funct. Anal. **267** no. 6, 1637-1661.

Earnshaw's theorem in electrostatics and a conditional converse to Dirichlet's theorem Séminaire Laurent Schwartz, École Polytéchnique, January 2014.

2015

Numerical analysis of very weakly well posed hyperbolic IVP, (with F. Colombini), IMA J. Numer. Anal. **35**, no. 3, 989-1010

The one way linearized water wave equation, (with G.I. Jennings and S. Karni), Bull. Inst. Math. Acad. Sin. (N.S.) **10**, no. 2, 259-281

A bound on the group velocity for Bloch wave packets, (with G. Allaire and M. Palombaro), Port. Math. **72**, no. 2, 119-123.

2016

Hyperbolic boundary value problems with trihedral corners, (with L. Halpern), Discrete Contin.

Dyn. Syst. **36**, no. 8, 4403-4450

Eigenvalues of Maxwell's equations with strictly dissipative boundary conditions (with F. Colombini and V. Petkov), Asymptot. Anal. **99**, no. 1-2, 105-124.

Preface to [Special issue dedicated to Peter D. Lax on the occasion of his ninetieth birthday], (with Chorin, A. J.), Discrete Contin. Dyn. Syst. **36** (2016), no. 8, iii. 35-06 (01A70).

<div align="center">2017</div>

Instabiity of dielectrics and conductors in an electrostatic field, (with G. Allaire), Arch. Rational Mech Anal. **224** no. 1, 233-268.

Convergence along mean flows, (with T. Holding and H. Hutridurga), SIAM Journal of Mathematical Analysis, **49** no. 2, 222-271.

Strictly dissipative boundary value problems at trihedral corners, (with Laurence Halpern), Seminaire Laurent Schwartz, exposé no 10, 10 pages.

Strictly dissipative nonuniqueness with corners (with Guy Métivier), in *Shocks, Singularities and Oscillations in Nonlinear Optics and Fluid Mechanics*, eds. F. Colombini, D. DelSanto, and D. Lannes, Springer, 141-151.

<div align="center">2018 - present</div>

Weakly hyperbolic systems by symmetrization, (with F. Colombini and T. Nishitani), Annali Scuola Normale Pisa, **19**(2019), 217-251.

Nobody's Perfect; Matched layers for heterogeneous media, with L. Halpern, L. Métivier, J. Ryan. SIAM J. Sci. Comput **41**(2019), A1-A25.

Variational crimes; homogenization for long times, with G. Allaire and A. Lamascz, Seminaire Schwartz 2019-2020.

Analysis of the experiment defining the dielectric constant, (with L.R. Scott), Indiana Univ. Math. J. **69** (2020), no. 5, 166-1683.

Boundedness of planar jump discontinuities for homogeneous hyperbolic systems, J. Hyperbolic PDE, **18**(2021), 511-538.

The electrostatic potential of periodic crystals, (with L.R. Scott), Siam J. Math. Anal., **53**(2021), no. 2, 1474-1491.

The charge-group summation method for electrostatics of periodic crystals, (with L.R. Scott), SIAM J. Appl. Math. **81** (2021), no. 2, 694-717.

A discrete algorithm for general weakly hyperbolic systems, (with F. Colombini, and T. Nishitani), J. Pseudo Differential Operators and Appl., **13**(2022), no. 2, Paper No. 20, 31 pp.

<div align="center">Accepted</div>

Variational crimes; homogenized wave equations for long times, with G. Allaire and A. Lamascz, J. Asymptotic Analysis.

Perfectly matched layers on cubic domains for Pauli's equaitions, (with L. Halpern), Toulouse Math. J.