CURRICULUM VITAE

Blake Temple

EDUCATION

Ph.D. University of Michigan	June, 1980	Mathematics
M.S. University of Michigan	June, 1976	Mathematics/Education
B.A. University of Michigan	June, 1973	Philosophy

APPOINTMENTS

- Distinguished Professor, Mathematics — July 2012
- Chair, Graduate Group in Appl. Math. — July 2004-July 2007
  University of California, Davis
- Professor — July 1990-
  University of California, Davis
- Chair, Graduate Group in Appl. Math. — July 1988-July 1990
  University of California, Davis
- Assistant Professor — July 1986-July 1988
  University of California, Davis
- Van Vleck Assistant Professor — Sept. 1984-June 1986
  University of Wisconsin
- Research Fellowship — Sept. 1983-Sept.1986
  MRC, University of Wisconsin
- Visiting Member — June 1982-Sept.1983
  Courant Institute
- N.S.F. Postdoctoral Fellow — Sept. 1980-July 1982
  Rockefeller University

HONORS

- *Guggenheim Fellow*, 1994-95
- *Five-Year NSF Award*, 2007-2012
- *Frederick W. and Lois B. Gehring Professor of Mathematics*, U-Mich, 2007
- *Distinguished Visiting Professor*, Taiwan and Hong Kong, 2009
- *Public Lecture to the National Academy of Sciences*, IISC, India, 2006
- *Visiting Scholar*, Konstanz University, Germany, 2008
- *Visiting Scholar*, Newton Institute, Cambridge, England, 2003
- *Visiting Scholar*, IHES, Paris, France, 2002
- *First Graduate Math Teaching Award*, UC-Davis, 1993

GRANTS:

2007-2014 NSF Applied Mathematics DMS-070-7532
Title: Shock-Free and Shock-Wave Dynamics
in General Relativity and Classical Fluids
Funding Level: $482,665

2004-07 NSF Applied Mathematics DMS-040-6096
Title: Shock waves and geometry
Funding Level: $183,307

2001-04 NSF Applied Mathematics DMS-010-2493
Title: Shock waves and geometry
Funding Level: $117,000

1998-01 NSF Applied Mathematics DMS-98-02473
Title: Shock waves and geometry
Funding Level: $117,000

1995-98 NSF Applied Mathematics DMS-95-000694
Title: The Geometry of Shock-waves
Funding Level: $92,000
(Plus $7800 matching funds from Office of Research)

1999-00 Faculty Research Grant Award
Title: Shock-waves
Funding Level: $3,000

1995-96 Faculty Research Grant Award
Title: Shock-waves and Geometry
Funding Level: $3,000

1996-97 Faculty Research Grant Award
Title: Shock-waves and Geometry
Funding Level: $3,000

1995-96 Faculty Research Travel Award
Funding Level: $700

1994-95 US NAVY N00014-94-1-0691
Title: Multi-Dimensional Shock-Waves for Relativistic Fluids
(with J. Smoller)
Funding Level: $42,339

1992-95 NSF Applied Mathematics DMS–92–06631
Title: Shock Waves and Conservation Laws
Funding Level: $91,000

1990-92 NSF Applied Mathematics DMS-8657319
Title: Shock Waves and Conservation Laws
Funding Levels: $45,400

1987-90 NSF US-China Cooperative Research Grant DMS-8657319
Title: Numerical and Analytical Studies in Nonlinear Waves
(with R. Leveque)
Funding Level: $12,128

1987-90 NSF Applied Mathematics DMS-8613450
Title: Systems of Conservation Laws: Analysis and Computation
Funding Level: $55,000

1986-94 86/90/92/94 UC-Davis Research Travel Grants

1987-88 Microcomputer research grant, UC-Davis

RESEARCH AREAS:

- Shock Waves
- General Relativity
- Partial Differential Equations
- Numerical Analysis
- Applied Mathematics

RESEARCH RECORD

2011 Invited Lecture Special Session *Conservation Laws*, AMS, San Diego
2010 Invited Lecture *Quantum Theory and GR*, Regensburg, Germany
2010 Contributed Talk, *Numerical Relativity*, SIAM Philadelphia
2010 Three Plenary Talks, PDE Conference, Wyoming
2010 Invited Lecture, CIMAT, Guanajuato, Mexico
2010 Geometry Seminar, Stanford
2010 Colloquium, Mechanical Engineering, UC-Davis
2009 Contributed Talk, *PDE of Fluids*, AMS Miami
2009 Distinguished Visiting Professor, Taiwan/Hong Kong
2009 Colloquium, National University of Taiwan
2009 Colloquium, Institute of Mathematics, Taiwan
2009 Colloquium, Central University of Taiwan
2009 Colloquium, City University of Hong Kong
2009 Distinguished Lecture, NPS
2009 PDE Seminar, UC Berkeley
2008 Applied Math Colloquium, Cal Tech
2008 Colloquium, Penn State
2008 Visiting Professor, Konstanz University, Germany
2008 Colloquium, Konstanz University, Germany
2008 Speaker, *Free Boundary Problems*, KTH Stockholm
2007 Contributed Talk, *Numerical Relativity*, AMS New Orleans
2007 Gehring Professor, (Three Lectures), University of Michigan
2007 Two Invited Lectures, University of Wyoming
2007 Invited Participant, IMA *Numerical Relativity*
2006 Public Lecture, National Academy of Sciences, India
2006 Visiting Professor, (Four Lectures), Indian Institute of Sciences
2006 Invited Lecture, Dept of Theoretical Physics, Chennai, India
2006 Conference Co-organizer *General Relativity and Shock Waves*, Stanford
2006 Talk, Georgetown University
2005 Colloquium, UC-Santa Cruz
2005 PDE Seminar, Georgia Tech
2004 Contributed Speaker, *Analysis of PDE*, AMS Los Angeles
2004 Colloquium, University of Mass, Ahmerst
2004 Plenary Talk: *Tenth Int'l Conference on Hyperbolic Problems*, Osaka, Japan

RESEARCH RECORD (Cont.)

2004 Plenary Talk: *Analysis, Modeling and Computation of PDE's*, SUNY Stony Brook
2003 *Evaluation Panel for NSF DMS Mathematical Analysis*
2003 Invited Speaker, (Four Lectures), *Newton Institute, Cambridge University*,
2003 *Gehring Visiting Professor*, University of Michigan, (Offer Declined)
2001 Invited speaker, conference in honor of Constantine Dafermos, Heidelberg, DE
2001 Visiting Scholar, IHES, Paris
2001 Hour talk, *VII Workshop on Partial Differential Equations*, IMPA, Brazil
2000 *MacArthur Fellows Program*, Nominator
2000 *Evaluation Panel for NSF DMS Applied Mathematics*
1999 Two Talks/Lecture Notes, *Systems of Conservation Laws*, EU Summerschool, Pfalz, DE
1999 Lecture, *Conference on Diff. Eqns. from Mechanics*, IMS, (organized by S.T. Yau)
1999 Hour Talk, *VI Workshop on Partial Differential Equations*, IMPA, Brazil
1999 *Evaluation Panel for NSF DMS Mathematical Analysis*
1999 Invited Speaker, *Analysis and Math. Phy.*, (Lars Garding on his 80'th B'day), Lund, SE
1999 Invited Participant, Oberwolfach
1996-98 *Evaluation Panel for NSF Postdoctoral Fellowships*
1995-99 *Mathematics Association of America Visiting Lecturer*
1998 Organizer, *National Conference and Special Session of AMS, UC-Davis*
1998 Invited Speaker, *Eighth ICCAM-98*, Leuven, Belgium
1997 One Month Visit, *Institut Mittag-Leffler*, Djursholm, Sweden
1997 Colloquium, Courant Institute, NYU
1995-96 *Professeur des Universites*, France
1995 Plenary Talk, *Saint-Jean-De-Monts*, France
1995 Invited Speaker, *IV International Workshop on PDE*, IMPA, Brazil
1995 Invited Participant, *In Honor of James Glimm on His 60'th Birthday,* SUNY, Stony Brook
1995-2005 Two Colloquia, Chico State University
1994 Visiting Scholar, Irwin Schrodinger Institute, Vienna, Austria.
1994 Invited Lecture, *ESI Conference on Mathematical Relativity*, Vienna, Austria.
1994 Plenary Talk, *Tenth Annual UC Conference on Nonlinear Science*, Davis CA
1994-95 GUGGENHEIM FELLOW
1991-92 *Sabbatical, University of Michigan*
1988-90 *Chair, Graduate Group in Applied Mathematics*
1982-83 Visiting Member, Courant Institute
1980-82 *NSF Postdoctoral Research Fellow*, (First Year of the Award), Rockefeller University

TALKS BY COLLABORATOR SMOLLER ON JOINT WORK

2010 Applied Math Colloquium, MIT
2010 Colloquium, Chinese University of HK
2010 Keynote Speaker, KAIST, (MIT of Korea)
2009 Joint Harvard-MIT-Brandeis Colloquium
2009 Colloquium, Indiana University
2009 Colloquium, University of Michigan
2004 Morningside Lecture, *Int'l Congress of Chinese Math's*, Hong Kong
2004 Invited Speaker, *Workshop in Hyperbolic Problems*, Stanford
2003 Plenary Lecture, *Int'l Conf. on Nonlin. Evol. Eqn's*, Evanston IL
2003 Rothschild Lecture, *Hyperbolic Models in Astrophysics and Cosmology*, Newton Institute, Cambridge University, U.K.
2001 Morningside Lecture, *Intern'l Congress of Chinese Math's*, Taipei
2001 Plenary Talk, *Int'l Conf. on Nonlin. Evol. PDE*, Yellow Mt., China
2001 Patton Lecture, Indiana University, Bloomington, IN
2000 Plenary Talk, *Conference for Burt Wendroff*, Los Alamos , NM
2000 Plenary Talk, *Eighth Int'l Conf. on Hyp. Probs*, Magdeburg, DE
2000 Analysis Seminar, MIT
2000 Colloquium, McGill University
1999 Plenary Talk, *IMS Conf. on Diff. Eqn's from Mech's*, Hong Kong
1999 Plenary Talk, *UAB-GIT Int'l Conf. on Math. Phys.*, Birmingham, AL
1999 Geometry Seminar, Harvard
1998 Seminar, Stanford University
1998 Plenary Talk, *Int'l Conf. on PDE and Num. Anal.*, Beijing, China
1997 Enricho Fermi Institute (University of Chicago)

RECENT PUBLICATIONS:

[**i**] *Causal dissipation and shock profiles in the fluid dynamics of pure radiation*, with H. Freistuehler. (Submitted to RSPA 2013).

[**ii**] *Subluminality and damping of plane waves in the causal dissipation of relativistic fluid dynamics*, with H. Freistuehler. (Submitted to RSPA 2013).

[**iii**] *Corrections to the Standard Model of Cosmology*, with J. Smoller.
Submitted by Invitation March 2013 for issue in honor of Marshall Slemrod, Comm. Inform. Sys.

[**iv**] *A Nash-Moser framework for finding periodic solutions to the compressible Euler equations*, with R. Young, Preprint, Proceedings University of Waterloo. Presented by R. Young, August 2013.

[**v**] *A canonical small divisor problem for the Nash-Moser Method*, with R. Young.
Submitted by Invitation March 2013 for issue in honor of Marshall Slemrod, Comm. Inform. Sys.

[**vi**] *Points of general relativistic shock wave interaction are"regularity singularities" where space-time is not locally flat*, with Moritz Reintjes,
Proc. R. Soc. A, 16 May, 2012, doi:10.1098/rspa.2011.0360.

[**vii**] *Simulation of general relativistic shock waves by a locally inertial Godunov method featuring dynamic time dilation*, with Zeke Vogler,
Proc. Roy. Soc. A, April 4, 2012, doi: 10.1098/rspa.2011.0355.

[**viii**] *A proof of convergence for the numerical approximations generated by the locally inertial Godunov method in general relativity*, with Z. Vogler, (submitted 2012).

[**ix**] *Expanding wave solutions of the Einstein equations that induce an anomalous acceleration into the standard model of Cosmology*, with Joel Smoller,
PNAS, Vol.106, no.34, 2009, pp. 14218-14218.

[**x**] *General Relativistic Self-Similar Waves that induce an Anomalous Acceleration into the standard model of Cosmology*, with J. Smoller,
Memoirs of the AMS, Nov. 3, 2011; S 0065-9266(2011)00641-6.

[**xi**] *A One Parameter Family of Expanding Wave Solutions of the Einstein Equations that induce an Anomalous Acceleration into the standard model of Cosmology*, with J. Smoller,
AMS/IP Studies in Advanced Mathematics Volume 51, 2011.

[**xii**] *The "Big Wave" Theory for Dark Energy*, with J. Smoller,
Proceedings: Quantum Field Theory and Gravity, Regensberg, Germany, Sept. 28-August 1, 2010.

[**xiii**] *Periodic Solutions of the Euler Equations: A paradigm for time-periodic sound wave propagation in the compressible Euler equations*, with R. Young,
Meth. Appl. of Anal. Vol. 16, No.3 pp. 341-364, September 2009.
[**xiv**] *Linear waves that express the simplest possible periodic structure of the compressible Euler equations*, with R. Young,
Acta Math. Scientia, Vol. 29, Ser. B, no. 6, 2010, pp. 1749-1766.

[**xv**] *Time periodic linearized solutions of the compressible Euler equations and a problem of small divisors*, with R. Young,
SIAM J. Math. Anal., Vol. 43, No. 1, 2011, pp. 1-49.

[**xvi**] *A Liapunov-Schmidt Reduction for Time-Periodic Solutions of the Compressible Euler Equations*, with R. Young,
Meth. Appl. Anal., Vol. 17, No. 3, pp. 225-262, September 2010.

The Following Book Appeared in 2007:

[**xvii**] *Shock wave interactions in general relativity: a locally inertial Glimm scheme for spherically symmetric spacetimes*, with Jeff Groah and Joel Smoller,
Springer, 2007, VIII, ISBN: 978-0-387-35073-8.

Other Articles:

[**xviii**] *A Proposal to Numerically Simulate a Cosmic Shock Wave by Use of a Locally Inertial Glimm Scheme*, Abstracts of the AMS, Numerical Relativity, AMS New Orleans, 2007.
(Beginning of program to simulate anomalous acceleration by expanding waves.)

[**xix**] *Answers to Questions Posed by Reporters*, with Joel Smoller.
(Supplement for Media after [vi] appeared in PNAS, August 19, 2009.)

[**xx**] *On viscosity and heat conduction for the relativistic fluid dynamics of pure radiation*, with H. Freistuehler. (Preprint 2011.)

[**xxi**] *Nash–Moser for Euler Newton*, with R.Young, (Preprint, July 2012).

[**xxii**] *Introduction to Linear and Nonlinear PDE*, (collaboration with M. Hafez, Mech Eng), undergraduate book on PDE. (In progress, posted on webpage.)

Student Doctoral Dissertations Completed Since 2006:

[**xxiii**] Thesis: *Global solution of the relativistic Euler equations in the ultra-relativistic limit*, Brian Wissman, 2007. Tenured Professor, University of Hawaii.

[**xxiv**] Thesis publication: *Global solutions of the ultra-relativistic Euler equations*, Brian Wissman, Commun. Math. Phys. 306, 831851 (2011).

[**xxv**] Thesis: *The Numerical Simulation of General Relativistic Shock Waves by a Locally Inertial Godunov Method Featuring Dynamical Time Dilation* , Zeke Vogler, 2010. Current UCD Postdoctoral instructor.

[**xxiv**] Thesis: *The Formation of a Regularity Singularity in General Relativity at the level of shock wave interactions*, Moritz Reintjes, 2011. Postdocs at University of Michigan and IMPA.

Undergraduate Research Papers:

[**xxv**] *Stability Results in the Theory of Relativistic Stars*, by Assad Lodia
UCD Senior in Physics, 2011.

[**xxvi**] *Why the curvature tensor needs 20 independent components*, by David Melgin
UCD Senior in Physics, 2011.

[**xxvii**] *Adding Lagrange Multipliers to the Schwarzschild Geometry*, by David Melgin
UCD Senior in Physics), 2011.

[**xxviii**] *The p-system*, by Shane Austin
UCD Freshman in Engineering, 2011.

PUBLICATIONS

[**1**] *Solutions in the large for the nonlinear hyperbolic conservation laws of gas dynamics*, (Thesis), Jour. Diff. Eqs., Vol 41, No.1, July 1981, pp. 96-161.

[**2**] *Stability and error bounds for a fractional step scheme to compute weak solutions to the waterhammer problem*, Presented at the University of Maryland, Feb. 6, 1981.

[**3**] *Global solution of the Cauchy problem for a class of* 2×2 *non-strictly hyperbolic conservation laws*, Adv. Appl. Math. 3, 1982, pp. 335-375.

[**4**] *The existence of a global weak solution of the waterhammer problem*, with M. Luskin, Comm. Pure Appl. Math. Vol. 35, 1982, pp. 697-735.

[**5**] *Systems of conservation laws with coinciding shock and rarefaction waves*, Contemporary Mathematics, Vol. 17, 1983, pp. 141-151.

[**6**] *Systems of conservation laws with invariant submanifolds*, Trans. Amer. Math. Soc., Vol 280, No. 2, 1983, pp. 781-795.

[**7**] *No* L^1 *contractive metrics for systems of conservation laws*, Trans. Amer. Math. Soc., Vol. 288, No.2, 1985, pp. 471-480.

[**8**] *Stability of Godunov's method for a class of* 2×2 *systems of conservation laws*, with R. Leveque, Trans. Amer. Math. Soc., Vol. 288, No.1, 1985, pp. 115-123.

[**9**] *Examples and classification of non-strictly hyperbolic systems of conservation laws*, with E.Isaacson, Abstracts of AMS, January 1985. (Start of program.)

[**10**] *Analysis of a singular hyperbolic system of conservation laws*, with E. Isaacson, Jour. Diff. Eqs., Vol.65, No.2., 1986, pp 250-286.

[**11**] *Decay with a rate for noncompactly supported solutions of conservation laws*, Trans. Am. Math. Soc., Vol. 298, No.1, 1986, pp. 43-82.

[**12**] *Stability and decay in systems of conservation laws*,
Lecture Notes in Mathematics, A. Dold and B. Eckmann, Springer-Verlag, 1986,
(Proceedings of the First International Conference on Hyperbolic Problems).

[**13**] *Degenerate systems of conservation laws*,
Contemporary Mathematics, Vol. 60, 1987, pp 125-133.

[**14**] *Continuous dependence in systems of conservation laws*,
in *Atlas Do Decimo Quinto Coloquio Brasileiro de Matematica*
(Proceedings of the Brazilian Math. Society), 1987, pp. 67-83.

[**15**] *On weak continuity and the Hodge decomposition*, with J. Robbin and R. Rogers,
Trans. Am. Math. Soc., Vol. 303, No. 2, 1987, pp. 609-618.

[**16**] *On the role of the characteristic set in the method of compensated compactness*,
with R. Rogers, Davis Preprint.

[**17**] *The Riemann problem near a hyperbolic singularity: the classification of
solutions of quadratic Riemann problems I*, with E. Isaacson,
D. Marchesin, B. Plohr, SIAM Jour. Appl. Math. Vol. 48, No. 5, 1988, pp. 1009-1032.

[**18**] *Classification of quadratic Riemann problems II*, with E.Isaacson,
SIAM Jour. Appl. Math. Vol. 48, No.6, 1988, pp.1287-1301.

[**19**] *Classification of quadratic Riemann problems III*, with E.Isaacson,
SIAM Jour. Appl. Math. Vol. 48, No.6,1988, pp. 1302-1318.

[**20**] *A characterization of the weakly continuous polynomials in the method
of compensated compactness*, with R. Rogers, Trans. Am. Math. Soc.,
Vol. 310, No. 1, 1988, pp. 405-417.

[**21**] *The L^1-norm distinguishes the strictly hyperbolic from the non-strictly hyperbolic
theory of the initial value problem for systems of conservation laws*,
in *Notes on Numerial Fluid Mechanics*, Vol. 24, 1988, pp. 608-616.

[**22**] *The structure of asymptotic states in a singular system of conservation laws*, with E.Isaacson, Adv. Appl. Math., Vol. 11, pp. 205-219 (1990)

[**23**] *Weak stability in the global L^1-norm for systems of hyperbolic conservation laws*, Trans. Am. Math. Soc., Vol. 317, No. 2, 1990, pp. 673-685.

[**24**] *Instability of rarefaction shocks for systems of conservation laws*, with J. Smoller and Z.P. Xin, Arch. Rational Mech. Anal., Vol. 112, 1990, pp. 63-81.

[**25**] *Nonlinear resonance in inhomogeneous systems of conservation laws*, with E.Isaacson, *Mathematics of Nonlinear Science*, Contemporary Mathematics, Vol. 108, 1990, pp. 63-77, (edited by M. S. Berger).

[**26**] *A connection for Fermi Transport in the theory of general relativity*, with G. Martin, Davis preprint.

[**27**] *Supnorm estimates in Glimm's method*, J. Diff. Eqs., Vol. 83, No.1, 1990, pp. 79-84.

[**28**] *On blowup in a resonant nonstrictly hyperbolic system*, by L.Lin, J.B.Temple and J.Wang, *Matematica Contemporanea*, IMPA, R. Iorio Jr. and D. Marchesin, Vol. 3, 1991, pp. 67-89. (Second Workshop on PDE).

[**29**] *On the convergence of Glimm's method and Godunov's method when wave speeds coincide*, Proceedings of the Second Int. Conf. on PDE, May 15-18, 1991.

[**30**] *From Newton to Einstein*, with C. Tracy, Am. Math. Monthly (Cover article), Vol. 99, No. 6, 1992, pp. 507-521.

[**31**] *Multiphase flow models with singular Riemann problems*, with E.Isaacson, D. Marchesin and B. Plohr, *Comp. and Appl. Math.*, Vol. 11, 1992, pp. 147-167.

[**32**] *Nonlinear resonance in systems of conservation laws*, with E. Isaacson, SIAM Jour. Appl. Math., Vol. 52, 1992, pp. 1260-1278.

[**33**] *Global solutions of the relativistic Euler equations*, with J. Smoller, Comm. Math. Phys., Vol. 156, 1993, pp. 67-99.

[**34**] *Multi-dimensional shock waves for relativistic fluids*, with J. Smoller, Proceedings of Conference on Shock Waves and Conservation Laws, Beijing, China, June, 1993.

[**35**] *Shock-wave solutions of the Einstein equations: The Oppenheimer-Snyder model of gravitational collapse extended to the case of non-zero pressure*, with J. Smoller, Arch. Rat. Mech. Anal., Vol. 128, 1994, pp 249-297.

[**36**] *Shock Waves and General Relativity*, with J. Smoller, *Journees Equations Aux Derivees Partielles*, Saint-Jean-De-Monts, June 1994, (6 pages).

[**37**] *Shock-waves in general relativity- A generalization of the Oppenheimer-Snyder model for gravitational collapse*, in *Nonlinear PDE and their applications*, College de France, Seminar Vol. **X**, edited by Brezis and Lions, 1994, (15 pages).

[**38**] *A comparison of convergence rates for Godunov's method and Glimm's method in resonant nonlinear systems of conservation laws*, with L.Lin and J. Wang., SIAM J. Numer. Anal., Vol. 32, No. 3, 1995, pp. 824-840.

[**39**] *Convergence of the* 2×2 *Godunov method for a general resonant nonlinear balance law*, with E. Isaacson, SIAM Jour. Appl. Math., Vol. 55, No. 3, 1995 pp. 625-640.

[**40**] *Suppression of oscillations in Godunov's method for a resonant non-strictly hyperbolic system*, with L. Lin and J. Wang, SIAM J. Numer. Anal., Vol. 32, No. 3, June 1995.

[**41**] *Astrophysical shock wave solutions of the Einstein equations*, with Joel Smoller, Phys. Rev. D, Vol. 51, No. 6 (March 1995).

[**42**] *The large time existence of periodic solutions for the compressible Euler equations*, with R. Young, *Contemporanea Mathematica*, IMPA, 1995, (Proceedings of the Fourth International Workshop on PDE).

[**43**] *Shock-wave explosions in general relativity*, with J. Smoller, *Journees Equations Aux Derivees Partielles*, Saint-Jean-De-Monts, XVII, 1995, pp. 1-20.

[**44**] *Shock-Waves and irreversibility in Einstein's theory of gravity*, with J. Smoller, *Hyperbolic Problems: Theory, Numerics, Applications*, edited by J. Glimm, M.J. Graham, J.W. Grove, and B.J. Plohr, 1996, pp. 81-90.

[**45**] *Solutions to the Euler Equations with Large Data*, with R. Young, *Hyperbolic Problems: Theory, Numerics, Applications*, edited by J. Glimm, M.J. Graham, J.W. Grove, and B.J. Plohr, 1996, p. 258-267.

[**46**] *The large time stability of sound waves*, with R. Young, Comm. Math. Phys, Vol. 179, 1996, pp. 417-466.

[**47**] *General relativistic shock-waves that extend the Oppenheimer-Snyder model*, with J. Smoller, Arch. Rat. Mech. Anal., Vol. 138, 1997, 239-277.

[**48**] *Shock-waves in general relativity*, with J. Smoller, *Harmonic Analysis and Nonlinear Differential Equations: A Volume in Honor of Victor Shapiro*, M. L. Lapidus, et al., Contemporary Mathematics, Vol. 208, 1997.

[**49**] *Multi-dimensional shock-waves for relativistic fluids*, with J. Smoller, AMS/IP Studies in Advanced Mathematics, Vol. 3, 1997, pp. 377-391.

[**50**] *Solutions of the Oppehheimer-Volkoff equations inside 9/8'ths of the Schwarzschild radius*, with J. Smoller, Comm. Math. Phys., Vol. 184, 1997, pp. 597-617.

[**51**] *Shock-waves near the Schwarzschild radius and the stability limit for stars*, with J. Smoller, Physical Review D, Vol. 55, No. 12, 1997 pp. 7518-7528.

[**52**] *Shock-wave solutions in closed form and the Oppenheimer-Snyder limit in general relativity*, with J. Smoller, SIAM J. Appl. Math, Vol. 58, No. 1, 1998, pp. 15-33.

[**53**] *On the Oppenheimer-Volkov equations in general relativity*, with J. Smoller, Arch. Rat. Mech. Anal., Vol. 142, 1998, pp. 177-191.

[**54**] *Applications of shock-waves in general relativity*, Proceedings of the VII Int'l Conf. on Hyperbolic Problems, Theory, Numer. and Appl., ETH Zurich, February, 1998.

[**55**] *Shock-wave solutions of the Einstein equations: A general theory with examples*, with J. Smoller, Proceedings of European Union Research Network's 3rd Annual Summerschool, Lambrecht (Pfalz) Germany, May 16-22, 1999.

[**56**] *Theory of a Cosmic Shock Wave*, with J. Smoller, Meth. Appl. of Anal., Vol. 8, no. 4, 2001, pp. 599-608.

[**57**] *Cosmology with a Shock-Wave*, with J. Smoller, Comm. Math. Phys. Vol. 210, 2000, pp. 275-308.

[**58**] *Shock-wave cosmology*, with J. Smoller, AMS/IP Studies in Advanced Mathematics, Vol. 16, 2000, pp. 351-359.

[**59**] *A shock-wave formulation of the Einstein equations*, with J. Groah, Methods and Applications of Analysis, Vol. 7, no. 4, 2000, pp. 793-812.

[**60**] *A locally inertial Glimm scheme for General Relativity*, with J. Groah, Seventh Workshop on Partial Differential Equations, Matematica Contemporanea, Vol. 22, 2002, pp. 163-179, edited by P. Dias, D. Marchesin, A. Nachbin, C. Tomei.

[**61**] *Lipschitz continuous metrics that solve the Einstein equations*, with J. Groah and J. Smoller, Handbook of Mathematical Fluid Dynamics, 2003, (series by Elsevier).

[**62**] *Shock-wave cosmology inside a black hole*, with J. Smoller, PNAS, Vol. 100, no. 20, 2003, pp. 11216-11218.

[**63**] *The generic solution of the Riemann problem in a neighborhood of a point of resonance for systems of nonlinear balance laws*, with J. Hong, Methods and Applications of Analysis, Vol. 10, No. 2, 2003, pp. 279-294.

[**64**] *Shock-wave solutions of the Einstein equations: Existence and consistency by a locally inertial Glimm Scheme*, with J. Groah, Memoirs of the AMS, Vol. 172, No. 813, November 2004.

[**65**] *Cosmology, Black Holes, and Shock Waves beyond the Hubble Length*, with J. Smoller, Meth. and Appl. of Anal., Vol. 11, No. 1, 2004, pp. 077-132.

[**66**] *A bound on the total variation of the conserved quantities for solutions of a general resonant nonlinear balance law*, with J. Hong, SIAM J. Appl. Math., Vol. 64, No. 3, 2004, pp. 819-857.

[**67**] *Shock wave cosmology inside a black hole: The case of non-critical expansion*, with J. Smoller, Journal of Hyperbolic Differential Equations, Vol. 1, 2004, pp.429-443.

[**68**] *Shock waves and cosmology*, with J. Smoller, Third International Conference of Chinese Mathematicians, Chinese University of Hong Kong, 2004.

[**69**] *How inflationary spacetimes might evolve into spacetimes of finite total mass*, with J. Smoller, Methods and Applications of Analysis, Vol. 12, No. 4, 2005, pp. 451-464.

[**70**] *A shock wave refinement of the Friedmann Robertson Walker spacetime*, with J. Smoller, Encyclopedia of Mathematical Physics, Elsevier, 2006.

[**71**] *How inflation is used to resolve the flatness problem*, with J. Smoller, Jour. of Hyp. Diff. Eqns., Vol. 3, no. 2, 2006, pp. 375-386.

[**72**] *Shock wave cosmology inside a Black Hole: A computer visualization*, with J. Smoller and Zeke Vogler, *Hyperbolic Problems: Theory, Numerics and Applications*, Vol. 1, F. Asakura, Yokahama Publishers (2006).

[**73**] *A Shock Wave Cosmology*, Patrika: Newsletter of the Indian Academy of Sciences, No. 43, pp 8-9, March 2006.

[**74**] *A Proposal to Numerically Simulate a Cosmic Shock Wave by Use of a Locally Inertial Glimm Scheme*, Abstracts of the AMS, *Numerical Relativity*, AMS New Orleans, 2007. (Beginning of program to simulate GR expansion waves.)

[**75**] *Shock wave interactions in general relativity: a locally inertial Glimm scheme for spherically symmetric spacetimes*, with J. Groah and J. Smoller, Springer, 2007, VIII, 152 p, ISBN: 978-0-387-35073-8.

[**76**] *Linear waves that express the simplest possible periodic structure of the compressible Euler equations* with R. Young, Acta Mathematica Scientia, Vol. 29, Ser. B, no. 6, 2010, pp. 1749-1766.

[**77**] *Periodic Solutions of the Euler Equations: A paradigm for time-periodic sound wave propagation in the compressible Euler equations*, with Robin Young, Meth. Appl. of Anal. (To Appear).

[**78**] *Time periodic linearized solutions of the compressible Euler equations and a problem of small divisors* with R. Young, SIAM Jour. of Math. Anal. (To Appear).

[**79**] *A Liapunov-Schmidt Reduction for Time-Periodic Solutions of the Compressible Euler Equations*, with Robin Young, Meth. Appl. of Anal., (To Appear).

[**80**] *Expanding wave solutions of the Einstein equations that induce an anomalous acceleration into the Standard Model of Cosmology*, Blake Temple and Joel Smoller, PNAS, Vol.106, no.34, 2009, pp. 14218-14218.

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Moritz Rientes. Moritz is working on the problem of determining the regularity of the gravitational metric at points of shock wave interaction in Groah-Temple shock wave theory.
2010 *The Numerical Simulation of General Relativistic Shock Waves by a Locally Inertial Godunov Method Featuring Dynamical Time Dilation* , Zeke Vogler, UC-Davis Doctoral Dissertation,, Winter 2010.
2007: *Global solution of the relativistic Euler equations in the ultra-relativistic limit*, Brian Wissman, UC-Davis Doctoral Dissertation, 2007. Now tenure track, Univ. of Hawaii.
2003: *A new large total variation stability result for the quadratic nonlinear system associated with the compressible Euler equations*, Thaddeus Edens, UC-Davis Doctoral Dissertation, NSF Postdoctoral Research Fellow 2004-06. Instructor at McGill University, Montreal.
2002: *General relativisitc shock waves propagating at the speed of light*, Michael Scott, UC-Davis Doctoral Dissertation, Postdoc at Kansas State, 2002-04, currently teaching at CSU Monterey Bay.
2000: *An extension of Glimm's method to inhomogeneous systems of conservation laws*, John Hong, UC-Davis Doctoral Dissertation, Postdoc at UCLA, 2000-03, Tenured Professor, National Central University, Taiwan, 2008-.
1996: *On the precession of planetary orbits induced by a Kerr metric,* Mathew Nelson, UC-Davis Masters Thesis:.
1995: *Solution of the Relativistic Euler Equations in Non-flat Spacetimes,* Jeff Groah, UC-Davis Doctoral Dissertation. Groah did a three year VRAP in Department of Mathematics, UC-Davis, is currently a tenured professor at Lone Star College in Texas..
1995: *On the Failure of the Hawking Singularity Theorem in the Smoller-Temple Shock-wave Model,* Richard Kavinoky, UC-Davis Doctoral Dissertation. Richard is currently teaching at Santa Rosa College.
1993: *A Functional Integral Approach to Bounding Wave Strengths in Spherically Symmetric Solutions of the Compressible Euler Equations*, Tong Yang, UC-Davis Doctoral Dissertation. Tong spent 93-94 as a Postdoctoral Fellow at the Institute for Advanced Study at Princeton University, and currently

holds a Chaired Professorship at City University of Hong Kong. Thesis publication in Comm. Math. Phys. Recipient of four silver Morningside Medals at the First International Congress of Chinese Mathematicians, Beijing, December 1998.
1991: *An Extension of Glimm's Method to Third Order*, Robin Young, UC-Davis Doctoral Dissertation. (Winner of UC-Davis Marr Prize and Winner of SIAM's DiPrima Prize for outstanding thesis in Applied Mathematics, 7-92. Young spent 91-94 as a Visiting Member at the Courant Institute, 94-7 as a postdoc working with James Glimm at Stony Brook, and is now full professor at Univ. of Mass. Thesis publication: *Supnorm stability for Glimm's scheme*, Comm. Pure and Appl. Math., Vol. XLVI, 1993, pp. 903-948.
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