

Curriculum Vitae

Marcelo Mendes Disconzi

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Contact information

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Research interests

Partial differential equations, geometric analysis, and mathematical physics.

Appointments

Title: Assistant Professor of Mathematics (tenure-track appointment).
Institution: Vanderbilt University.
Period: Fall 2014 – Present.

Title: Non-tenure track Assistant Professor of Mathematics (Post-doc).
Institution: Vanderbilt University.
Period: Fall 2012 – Fall 2014.
Mentor: Gieri Simonett.

Degrees earned

Degree: Ph.D. in Mathematics.
Institution: Stony Brook University (State University of New York at Stony Brook).
Period: August 2006 – May 2012.
Advisor: Marcus A. Khuri.
Thesis title: Compactness and Non-compactness for the Yamabe Problem on Manifolds With Boundary.

Degree: M.S. in Mathematics.
Institution: Universidade Federal do Rio Grande do Sul, Brazil.
Period: June 2003 – July 2005.
Advisor: Alexandre T. Baraviera.
Thesis title: Transição de fases em redes de mapas acoplados (Phase transitions in coupled map lattices, in Portuguese).

Degree: M.S. in Physics.
Institution: Universidade Federal do Rio Grande do Sul, Brazil.
Period: March 2003 – March 2005.
Advisor: Leonardo G. Brunnet.

Thesis title: Sistemas extensos com dimensão instável invariante (Extended systems with invariant unstable dimension, in Portuguese).

Degree: B.Sc. in Physics.

Institution: Universidade Federal do Rio Grande do Sul, Brazil.

Period: March 1999 – December 2002.

Publications

Mathematical papers (proof based, mathematically rigorous results):

1. Chan, C. H.; Czubak, M.; Disconzi, M. M. *The formulation of the Navier-Stokes equations on Riemannian manifolds*. Journal of Geometry and Physics, to appear. 16 pages. arXiv: 1608.05114 [math.AP].
2. Disconzi, M. M.; Ebin, D. G. *Motion of slightly compressible fluids in a bounded domain, II*. Communications in Contemporary Mathematics, Vol. 19, Issue 4, pp. 1650054, 57 pages (2017).
3. Disconzi, M. M.; Khuri, M. A. *Compactness and non-compactness of the Yamabe problem on manifolds with boundary*. J. Reine Angew. Math. (Crelle's Journal), Vol. 2017, Issue 724, pp. 145-201 (2017).
4. Disconzi, M. M.; Ebin, D. G. *The free boundary Euler equations with large surface tension*. Journal of Differential Equations, Vol. 261, Issue 2, pp. 821-889 (2016).
5. Disconzi, M. M.; Czubak, M. *On the well-posedness of relativistic viscous fluids with non-zero vorticity*. Journal of Mathematical Physics, Vol. 57, Issue 4, pp. 042501, 21 pages (2016).
6. Disconzi, M. M.; Shao, Y.; Simonett, G. *Some remarks on uniformly regular Riemannian manifolds*. Mathematische Nachrichten, Vol. 289, No. 2-3, pp. 232-242 (2016).
7. Disconzi, M. M. *Remarks on the Einstein-Euler-Entropy system*. Reviews in Mathematical Physics, Vol. 27, No. 6, pp. 1550014, 45 pages (2015).
8. Disconzi, M. M. *On the well-posedness of relativistic viscous fluids*. Nonlinearity, Vol. 27, No. 8, pp. 1915-1935 (2014).
9. Disconzi, M. M. *On a linear problem arising in dynamic boundaries*. Evolution Equations and Control Theory, Vol. 3, No. 4, pp. 627-644 (2014).
10. Disconzi, M. M.; Pingali, V. P. *On the Choquet-Bruhat – York – Friedrich formulation of the Einstein-Euler equations*. Modern Physics Letters A, Vol. 29, No. 39, pp. 1450205, 16 pages (2014).
11. Dabholkar, S. P.; Disconzi, M. M.; Pingali, V. P. *Remarks on positive energy vacua via effective potentials in string theory*. Letters in Mathematical Physics, Vol. 104, Issue 7, pp. 893-910 (2014).

12. Disconzi, M. M.; Ebin, D. G. *On the limit of large surface tension for a fluid motion with free boundary*. Communications in Partial Differential Equations, Vol. 39, Issue 4, pp. 740-779 (2014).
13. Disconzi, M. M.; Douglas, M. R.; Pingali, V. P. *On the boundedness of effective potentials arising from string compactifications*. Communications in Mathematical Physics, Vol. 325, Issue 3, pp. 847-878 (2014).
14. Disconzi, M. M. *A priori estimates for a critical Schrödinger-Newton equation*. Electronic Journal of Differential Equations, Ninth MSU-UAB, Conference 20, pp. 39-51 (2013) (refereed conference proceedings).
15. Disconzi, M. M. *A note on quantization in the presence of gravitational shock waves*. Modern Physics Letters A, Vol. 28, No. 31, pp. 1350111, 17 pages (2013).
16. Disconzi, M. M.; Khuri, M. A. *The charged Penrose inequality for a spherically symmetric black hole*. Res. Inst. Math. Sci. Kôkyûroku, Kyoto Univ., 1862, 6 pages (2013).
17. Disconzi, M. M.; Khuri, M. A. *On the Penrose inequality for charged black holes*. Classical and Quantum Gravity, Vol. 29, No. 24, pp. 245019, 18 pages (2012).
18. Di Cerbo, L. F.; Disconzi, M. M. *Yamabe solitons, determinant of the Laplacian and the Uniformization Theorem for Riemann surfaces*. Letters in Mathematical Physics, Vol. 83, No. 1, pp. 13-18 (2008).

Physics papers (applications, mathematically non-rigorous results):

19. Disconzi, M. M.; Kephart, T. W.; Scherrer, R. J. *On a viable first order formulation of relativistic viscous fluids and its applications to cosmology*. International Journal of Modern Physics D, Vol. 27, pp. 1750146, 52 pages (2017).
20. Silvestrini, M.; Brunnet, L. G.; Disconzi, M. M.; Brito, C. *Initial condition dependence and wave-function confinement in the Schrödinger-Newton equation*. General Relativity and Gravitation, Vol. 47, Issue 11, pp. 129, 23 pages (2015).
21. Disconzi, M. M.; Kephart, T. W.; Scherrer, R. J. *New approach to cosmological bulk viscosity*. Physical Review D, Vol. 91, Issue 4, pp. 043532, 6 pages (2015).
22. Baraviera, A. T.; Disconzi, M. M. *Asymptotic states in coupled map lattices*. International Journal of Bifurcation and Chaos, Vol. 18, Issue 2, pp. 285-311 (2008).
23. Disconzi, M. M.; Brunnet, L. G. *Analysis of high dimensional non-hyperbolic coupled systems through finite-time Lyapunov exponents*. Physica A, Vol. 387, Issues 2-3, pp. 425-431 (2008).
24. Disconzi, M. M.; Brunnet, L. G. *Dynamics at the interface dividing collective behavior and synchronized states in a CML*. Physica A, Vol. 360, Issue 2, pp. 159-170 (2006).

Pre-prints

1. Disconzi, M. M.; Kukavica, I. *A priori estimates for the 3D compressible free-boundary Euler equations with surface tension in the case of a liquid*. arXiv: 1708.00861 [math.AP], 40 pages (2017).

2. Disconzi, M. M.; Kukavica, I. *A priori estimates for the free-boundary Euler equations with surface tension in three dimensions*. arXiv: 1708.00086 [math.AP], 40 pages (2017).
3. Benson, B. A.; Disconzi, M. M. *A note on a Newtonian approximation in a Schwarzschild background*. Submitted, 12 pages (2016).

Grants

Title: International Conference on Evolution Equations.
 Funding agency: National Science Foundation (Analysis Program).
 Type: Conference grant.
 Role: Co-Principal Investigator.
 Amount: \$40,000.
 Period: 04/01/2016 – 03/31/2017.

Title: Shanks Workshop on Geometric Analysis.
 Funding agency: National Science Foundation (Geometric Analysis Program).
 Type: Conference grant.
 Role: Principal Investigator.
 Amount: \$12,000.
 Period: 03/01/2016 – 02/28/2017.

Title: Analytic Problems in the Physics of Fluids, Gravitation and Conformal Geometry.
 Funding agency: National Science Foundation (Mathematical Physics Program).
 Type: Research grant.
 Role: Principal Investigator.
 Amount: \$93,424.
 Period: 09/01/2013 – 08/31/2017.

Title: The Navier-Stokes equations in curved backgrounds.
 Funding agency: Vanderbilt University (International Research Grant).
 Type: Research grant.
 Role: Principal Investigator.
 Amount: \$8,000.
 Period: 5/13/2015 – 6/30/2017.

Title: Shanks Workshop on Mathematical Aspects of Fluid Dynamics.
 Funding agency: National Science Foundation (Analysis Program).
 Type: Conference grant.
 Role: Principal Investigator.
 Amount: \$10,650.
 Period: 12/15/2014 – 11/30/2015.

Honors and awards

Research in pairs at the Mathematical Research Institute of Oberwolfach. July 10 – August 6, 2016. Oberwolfach, Germany.

Aldroubi-Azhari Prize for Excellence in Postdoctoral Research (Mathematics Department, Vanderbilt University, Spring 2014).

Chairman's Award for Excellence in Teaching (Mathematics Department, Stony Brook University, 2012).

Stony Brook University Nominee for the 2012 MSRI Summer Graduate Workshop in Mathematical Relativity (MSRI, CA, July, 2012).

Assistantship-Scholarship (Mathematics Department, Stony Brook University, 2006 – 2012).

Presidential Fellowship (Stony Brook University, 2008 – 2010).

Distinction in the Ph.D. Oral Exam (Mathematics Department, Stony Brook University, 2008).

Fulbright-CAPES Graduate Fellowship (declined, 2005).

Graduate Research Fellowship (CNPq, Brazil, 2003 – 2005).

Undergraduate Fellowship (FAPERGS, Brazil, 2000 – 2002).

Invited talks

Year 2018:

(upcoming) *TBA*. Spring Central Sectional Meeting of the AMS, Columbus, OH. March 2018.

(upcoming) *TBA*. Joint Mathematics Meetings, San Diego, CA, January 2018.

Year 2017:

(upcoming) *Viscous fluids in general relativity*. 3rd Annual Meeting of SIAM Central States Section, Fort Collins, CO, September 2017.

(upcoming) *Viscous fluids in general relativity*. Colloquium, Department of Mathematics, Baylor University, Waco, TX, September 2017.

(upcoming) *TBA*. PDE Seminar, Department of Mathematics, University of Tennessee at Knoxville, Knoxville, TN, August 2017.

(upcoming) *Viscous fluids in general relativity*. Plenary speaker at the Second USA and Uzbekistan Joint Math Conference, Urgench, Uzbekistan, August 2017.

The three-dimensional free-boundary Euler equations with surface tension. Spring Eastern Sectional Meeting of the AMS, New York, NY, May 2017.

The three-dimensional free boundary Euler equations with large surface tension. Analysis and PDE seminar, University of Southern California, Los Angeles, CA, March 2017.

Viscous fluids in general relativity and the Einstein-Navier-Stokes equations. Colloquium, Department of Mathematics, University of Southern California, Los Angeles, CA, March 2017.

Existence, regularity, and convergence results for the free-boundary Euler equations. PDE, Complex Analysis and Differential Geometry Seminar, University of Notre Dame, South Bend, IN, March 2017.

A priori estimates for the free-boundary Euler equations with surface tension in three dimensions. Spring Southeast Sectional Meeting of the AMS, Charleston, SC, March 2017.

The three-dimensional free boundary Euler equations with surface tension. PDE Seminar, Purdue University, West Lafayette, IN, February 2017.

Year 2016:

The three-dimensional free boundary Euler equations with surface tension. Analysis and PDE Seminar, UC Berkeley, Berkeley, CA, September 2016.

Viscosity in General Relativity. AstroCoffee, Goethe University, Frankfurt, Germany, July 2016.

The free boundary Euler equations in 3D. 11th AIMS conference on Dynamical Systems, Differential Equations and Applications, Orlando, FL, July 2016.

The three-dimensional free boundary Euler equations with surface tension. Recent Advances in Hydrodynamics, Banff International Research Station for Mathematical Innovation and Discovery, Alberta, Canada, June 2016.

The free boundary Euler equations in 3D. Analysis and PDE Seminar, University of Kentucky, Lexington, KY, March 2016.

The Einstein-Navier-Stokes system. AMS Sectional Meeting, Stony Brook University, Stony Brook, NY, March 2016.

The free boundary Euler equations in 3D. AMS Sectional Meeting, Stony Brook University, Stony Brook, NY, March 2016.

The free boundary Euler equations in 3D. AMS Sectional Meeting, University of Georgia Athens, Athens, GA, March 2016.

The free boundary Euler equations in 3D. Applied Math & PDEs Seminar, UC Davis, Davis, CA, February 2016.

Year 2015:

Coupling Einstein and Navier-Stokes equations. Nonlinear Parabolic Equations and Applications, SIAM Conference on Analysis of Partial Differential Equations, Scottsdale, AZ, December 2015.

The Einstein-Navier-Stokes system. Geometry and Topology Seminar, Department of Mathematics, University of Tennessee at Knoxville, Knoxville, TN, March 2015.

The Einstein-Navier-Stokes system. AMS Sectional Meeting, University of Alabama in Huntsville, Huntsville, March 2015.

Year 2014:

The incompressible limit of the Euler equations in a domain with boundary. Southeastern Atlantic Regional Conference on Differential Equations, Memphis, TN, October 2014.

The evolution problem for Einstein's equations coupled to viscous fluids. PDE and Differential Geometry Seminar, Department of Mathematics, University of Connecticut, CT, March 2014.

The free boundary Euler equations with large surface tension. Analysis and Geometry Seminar, University of Colorado at Boulder, Boulder, CO, March 2014.

The relativistic Navier-Stokes and Einstein's equations. Colloquium, Department of Mathematics, Rutgers University, NJ, March 2014.

Slightly compressible fluids in a bounded domain. The 4th Ohio River Analysis Meeting, Lexington, KY, March 2014.

The Compressible and Incompressible Euler equations: existence, regularity and convergence results. Colloquium, University of Hawaii, Honolulu, HI, February 2014.

Year 2013:

Existence, regularity, and convergence results for the compressible Euler equations. Analysis and Partial Differential Equations Seminar, John Hopkins University, Baltimore, MD, November 2013.

On the well-posedness of relativistic viscous fluids. Analysis Seminar, Binghamton University, Binghamton, NY, October 2013.

Curved backgrounds, singularities, and renormalization: why is it so difficult to quantize gravity? Colloquium, Instituto de Física, UFRGS, Brazil, May 2013.

The Einstein system for inviscid and viscid relativistic fluids. Colloquium, Instituto de Matemática e Estatística, USP, Brazil, May 2013.

Large surface tension and other limits for the Euler equations. Applied Math & PDEs Seminar, UC Davis, Davis, CA, April 2013.

Year 2012:

On the Einstein Equations for Relativistic Fluids. Plenary speaker at the XXI Southeast Geometry Seminar, University of Tennessee, Knoxville, December 2012.

Motion of Slightly Compressible Fluids in a Bounded Domain. Analysis Seminar, Binghamton University, Binghamton, NY, March 2012.

Year 2011:

Compactness and Non-compactness of the Yamabe Problem on Manifolds with Boundary. Geometry and Analysis Seminar, Columbia University, New York, NY, October 2011.

Compactness and Non-compactness of the Yamabe Problem on Manifolds with Boundary. Differential Geometry Seminar, CUNY Graduate Center, New York, NY, October 2011.

Holographic Renormalization and Correlation Functions. Complex Systems Seminar, Instituto de Física, UFRGS, Brazil, June 2011.

Year 2009:

Holographic Renormalization and Correlation Functions. RTG Seminar in Geometry and Physics, Stony Brook University, Stony Brook, NY, May 2009.

Year 2008:

Some Geometry on the Chains and Cochains of a Manifold. Graduate Student Seminar, Stony Brook University, Stony Brook, NY, December 2008.

Feynman Diagrams in φ^4 Theory. Series of three talks presented at the RTG Seminar in Geometry and Physics, Stony Brook University, Stony Brook, NY, November 2008.

Some ideas in Conformal Field Theory. RTG Seminar in Geometry and Physics, Stony Brook University, Stony Brook, NY, February 2008.

Years 2012 – Present:

Several seminars presented at Vanderbilt University. PDE Seminar; Symplectic and Differential Geometry Seminar; Joint Differential and Non-Commutative Geometry Seminar;

Contributed talks

Year 2015:

The free-boundary Euler equations: existence and convergence results. The Ninth IMACS International Conference on Nonlinear Evolution Equations and Wave Phenomena: Computation and Theory, University of Georgia, Athens, GA, April 2015.

Year 2014:

The free boundary Euler equations with large surface tension. Mini Conference on Topics in Euler's equation for incompressible fluids, University of Notre Dame, South Bend, IN, May 2014.

Year 2012:

On the Fluid Motion with Free Boundary and Strong Surface Tension. 9th Differential Equations and Computational Simulations, Mississippi State University, Starkville, MS, October 2012.

Year 2011:

A Compactness Theorem for the Yamabe Problem on Manifolds with Boundary. 68th Midwest PDE Seminar, University of Notre Dame, South Bend, IN, November 2011.

A Compactness Theorem for the Yamabe Problem on Manifolds with Boundary. 2011 Barrett Memorial Lectures in Mathematical Relativity, University of Tennessee, Knoxville, TN, May 2011.

Conferences attended

Twenty-sixth Southeast Geometry Seminar, February 26, 2017. Georgia Institute of Technology, Atlanta, GA.

General Relativity: a celebration of the 100th anniversary, November 16 – 20, 2015, Institut Henri Poincaré, Paris, France.

Mathematical Problems in General Relativity, Workshop, January 19 – 23, 2015, Simons Center for Geometry and Physics, Stony Brook University, Stony Brook, NY.

Geometrical Aspects of Hydrodynamics, Workshop, May 19 – 23, 2014, Simons Center for Geometry and Physics, Stony Brook University, Stony Brook, NY.

29th Annual Geometry Festival. Stony Brook University, Stony Brook, NY, April 2014.

International Conference on Cycles, Calibrations and Nonlinear Partial Differential Equations: Celebrating Blaine Lawson's 70th Birthday, Stony Brook University, NY, October 2012.

Evolution Equations: A Workshop in Honor of Terence Tao, Northwestern University, Evanston, IL, May 2012.

Mathematical Foundations of Quantum Field Theory, Stony Brook University, Stony Brook, NY, January 2012.

7th Simons Workshop in Mathematics and Physics, Stony Brook University, Stony Brook, NY, July – August 2009.

24th Annual Geometry Festival. Stony Brook University, Stony Brook, NY, April 2009.

6th Simons Workshop in Mathematics and Physics, Stony Brook University, Stony Brook, NY, June – July 2008.

Stony Brook Dialogues in Mathematics and Physics: A Symposium in Honor of Chen N. Yang and James H. Simons, Stony Brook University, Stony Brook, NY, March 2008.

5th Simons Workshop in Mathematics and Physics, Stony Brook University, Stony Brook, NY, July – August 2007.

International Congress on Mathematical Physics, Rio de Janeiro, RJ, Brazil, August 2006.

Teaching-related activities

Undergraduate advisor.

Mathematics Department, Vanderbilt University.

Fall 2014 – Present.

Students (with graduation term): Nicholas F. Beier (Spring 2016), Yanru Chen (Spring 2016), Cameron T. Togrye (Spring 2016), Corey L. Lockridge (Spring 2017), Carter O. Portwood (Spring 2017), Lexie A. Tonelli (Spring 2017), Alexander J. Link (Spring 2019).

Member of the Graduate Qualifying Exam Committee.

Electrical Engineering and Computer Science Department, Vanderbilt University.

Student: Hangfang Zhang (advisor: Bharat Bhuvu).

Spring 2017.

Member of Undergraduate Honors Thesis Committee.

Physics Department, Vanderbilt University.

Student: Zachary F. Bednarke (advisor: Thomas W. Kephart).
Spring 2017.

Member of the Graduate Qualifying Exam Committee.
Physics Department, Vanderbilt University.
Student: Mahmoud Parvizi (advisor: Robert J. Scherrer).
Spring 2017.

Member of Undergraduate Honors Thesis Committee.
Mathematics Department, Vanderbilt University.
Student: Yue Zhou (advisor: Glenn Webb).
Spring 2016.

Undergraduate Honors Thesis advisor.
Mathematics Department, Vanderbilt University.
Student: Tennessee Joyce.
Spring 2016.

Member of the Graduate Qualifying Exam Committee.
Mathematics Department, Vanderbilt University.
Student: Oleksandr Vlasuk (advisor: Edward Saff).
Spring 2015.

Member of the Graduate Qualifying Exam Committee.
Physics Department, Vanderbilt University.
Student: Bradley Lewis Rachlin (advisor: Thomas W. Kephart).
Spring 2015.

Service

Service to the department:

Member of the Post-doc Recruitment Committee, 2016–2017 (Mathematics Department, Vanderbilt University).

Member of the Teaching Committee, 2016–2017 (Mathematics Department, Vanderbilt University).

Member of the Colloquium Committee, 2015 – 2016 (Mathematics Department, Vanderbilt University).

Member of the Graduate Committee, 2015 – 2016 (Mathematics Department, Vanderbilt University).

Chair of the Preliminary Examination Committee in Analysis for August 2016 exams (Mathematics Department, Vanderbilt University).

Member of the Preliminary Examination Committee in Analysis for January 2016 exams (Mathematics Department, Vanderbilt University).

Member of the Preliminary Examination Committee in Analysis for August 2015 exams (Mathematics Department, Vanderbilt University).

Member of the Graduate Student Recruitment Committee, 2014 – 2015 (Mathematics Department, Vanderbilt University).

Area representative in the Schedule of Classes Committee, 2014 – 2015 (Mathematics Department, Vanderbilt University).

Service to the University:

Member of the Fisk-Vanderbilt Master's-to-PhD Program Steering Committee, 2015 – 2016 (Vanderbilt University).

Service to the profession:

Referee for several mathematical journals.

Reviewer, Mathematical Reviews, MR Database, MathSciNet.

Organizer, Partial Differential Equations Seminar (Mathematics Department, Vanderbilt University).

Organizer (with Joe Fu), *XXVII Southeast Geometry Seminar* (Vanderbilt University, August 26, 2017).

Grant reviewer, Xi'an Jiaotong-Liverpool University (China), May 2017.

Organizer (with Giusy Mazzone and Gieri Simonett), *2017 Shanks Workshop on Mathematical Aspects of Fluid Dynamics* (Vanderbilt University, April 8 – 9, 2017).

Organizer (with Lorena Bociu), *Free-boundary fluid models and related problems* at the Spring Southeastern Sectional Meeting, Meeting # 1126 (College of Charleston, Charleston, SC, March 10 – 12, 2017).

Guest editor, *Evolution Equations and Control Theory, Special Issue on Fluid-Structure Interactions*. Volume 4, Number 4, December 2016.

Co-chair, *International Conference on Evolution Equations in conjunction with the 31st annual Shanks Lecture, With a special tribute to the work of Jan Prüss on the occasion of his 65th birthday* (Vanderbilt University, May 16 – 20, 2016).

Organizer (with Ioana Suvaina), *Shanks Workshop on Geometric Analysis* (Vanderbilt University, March 11 – 12, 2016).

Organizer (with Irena Lasiecka, Justin Webster, and Daniel Toundykov), *Mini symposium on analysis and control of fluid models and flow-coupled systems* at the SIAM Conference on Analysis of Partial Differential Equations (Scottsdale, Arizona, December 7 – 10, 2015).

Organizer (with Gieri Simonett), *Shanks Workshop in Mathematical Aspects of Fluid Dynamics* (Vanderbilt University, February 28 – March 1, 2015).

Other academic experience

Research in pairs at the Mathematical Research Institute of Oberwolfach. July 10 – August 6, 2016. Oberwolfach, Germany.

High frequency vibrations and Riemannian geometry, IdeaLab 2014, Program for Early Career Researchers, August 11 – 15, 2014. Brown University, RI.

Mini Conference on Topics in Euler's equation for incompressible fluids, May 14 – 16, 2014. University of Notre Dame, IN.

Initial Data and Evolution Problems in General Relativity, Workshop, November 18 – 22, 2013. MSRI, CA.

MSRI Summer Graduate Workshop in Mathematical Relativity, 2 week workshop, July 2012. MSRI, CA.

Mathematical Foundations of Quantum Field Theory. Summer course, January – February, 2006. IMPA (National Institute of Pure and Applied Mathematics, Brazil).

Mathematics and Quantum Field Theory. Summer course, January – February, 2005. IMPA (National Institute of Pure and Applied Mathematics, Brazil).

Membership

Member, American Mathematical Society, 2006 – Present.