

Curriculum Vitae
List of Publications

Matilde Marcolli

2017

Citizenship: Italian

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Education

- June, 1997: Ph.D. Mathematics, The University of Chicago. Dissertation: *Three-dimensional aspects of Seiberg-Witten gauge theory*; Thesis advisor: Prof. Mel Rothenberg.
- December, 1994: Master Sc., Mathematics, The University of Chicago.
- June, 1993: *Laurea* in Physics, 110/110 summa cum laude, Università degli Studi, Milano Italy. Dissertation: *Classes of self equivalences of fibre bundles*; Thesis advisor: Professor R. A. Piccinini (Department of Mathematics).
- June 1988: *Maturità classica* 60/60, Liceo Classico A. Volta, Como Italy.

Employment History

Current and past academic positions

- **2008-present** Professor, Department of Mathematics, California Institute of Technology.
- **2017-present** Distinguished Visiting Research Chair, Perimeter Institute for Theoretical Physics.
- **2013-2016** Distinguished Visiting Research Chair, Perimeter Institute for Theoretical Physics.
- **2003-2008** Associate Professor (with tenure), Max Planck Institute for Mathematics.

- **2000-2003:** Associate Professor, Max Planck Institut for Mathematics, Bonn, Germany.
- **1997-2000:** C.L.E. Moore Instructor, Department of Mathematics, Massachusetts Institute of Technology, USA.

Courtesy appointments

- **2006-2010** Honorary Professor, Bonn University, Germany.
- **2001-present:** Courtesy appointment (Associate Professor – Professor), Mathematics Department, Florida State University, USA

Honors, Grants and Awards

Recent Distinguished Conference Invitations

- Opening plenary lecture at “Geometric Science of Information”, École Polytechnique, Paris, France, October 2015.
- Plenary speaker at the Pacific Rim Mathematical Association Congress, Shanghai, June 2014.
- Invited Speaker (Mathematical Physics) International Congress of Mathematicians, Hyderabad, August 2010.
- Plenary Speaker for the 5th European Congress of Mathematics, Amsterdam, July 2008.

Scientific Awards

- **2002** Sofja Kovalevskaya Award of the Alexander von Humboldt Foundation and the ZIP Program of the German Government.
- **2001:** Heinz Maier Leibnitz Prize awarded by the Deutsche Forschungsgemeinschaft

Support from the National Science Foundation

- **2012** National Science Foundation (NSF) grant PHY-1205440 “Non-commutative Geometry Models for Physics”
- **2012** National Science Foundation (NSF) grant DMS-1201512 “Motivic Structures in Physics”
- **2010** National Science Foundation (NSF) grant DMS-1007207 “Arithmetic Noncommutative Geometry”.
- **2009** National Science Foundation (NSF) grant DMS-0901221 “Feynman motives”.
- **2007**: National Science Foundation (NSF) grant DMS-0651925 (part of NSF Focused Research Group “Noncommutative Geometry and Number Theory”, with Alain Connes, Caterina Consani, Henri Moscovici)
- **1998**: National Science Foundation (NSF) grant DMS-9802480 “Seiberg–Witten Floer Theory”

Other Grants

- **2010** Australian Research Council, Grant DP1092682 (with Alan Carey and Bai-Ling Wang) “Invariants of singular spaces from noncommutative geometry”
- **2007** Australian Research Council, Grant DP0769986 “Geometric problems from quantum theory” (with Alan Carey and Michael Murray)
- **2004**: Australian Research Council, Grant DP0449470 “Geometric methods in quantum theory” (with Alan Carey and Michael Murray)
- **1995**: *Borsa di Studio e Ricerca*, Research Grant awarded by the National Council of Research (CNR) of Italy.

Short Term Visiting Positions

- **January-May 2013**: Research Professor, Mathematical Sciences Research Institute, Berkeley

- **January-April 2009:** Research Professor, Mathematical Sciences Research Institute, Berkeley
- **July 2009:** Max Planck Institute for Mathematics.
- **April 2007:** Visitor at the Mittag Leffler Institute
- **November 2006:** Newton Institute Cambridge, UK.
- **November 2005:** Visitor at the Kavli Institute of Theoretical Physics Santa Barbara
- **May 2005:** Visitor (Kempf Lectures), Johns Hopkins university
- **April-May 2005:** Visiting scholar, Vanderbilt University
- **June 1999:** Visiting position at the Max Planck Institute for Mathematics
- **January 1999:** Visiting position at the Tata Institute of Fundamental Research
- **June-August 1998:** Visiting position at the Max Planck Institute for Mathematics
- **July 1996:** Guest of the program “Research in Pairs” (for collaborative research with M. Spreafico) at the Mathematisches Forschungsinstitut Oberwolfach

Journal Editor

- Letters in Mathematical Physics
- Journal of Mathematical Physics
- Journal of Geometry and Physics
- Springer Briefs in Mathematical Physics
- Mathematics in Computer Science
- Journal of Fractal Geometry

- Journal of Noncommutative Geometry
- p-adic Numbers, Ultrametric Analysis and Applications
- Bulletin of the Italian Mathematical Union
- Analysis, Geometry, and Number Theory
- Advances in Mathematical Physics (2008-2014)

List of Refereed Publications

Books authored

1. *Noncommutative Cosmology*, World Scientific, to appear in 2017.
2. *Feynman Motives*, World Scientific, 2010.
3. *Noncommutative Geometry, Quantum Fields and Motives*, (with Alain Connes) Colloquium Publications, Vol.55, American Mathematical Society, 2008.
4. *Arithmetic noncommutative geometry*, University Lectures Series, Vol.36, American Mathematical Society, 2005.
5. *Seiberg–Witten gauge theory*, Texts and Readings in Mathematics, Vol.17, Hindustan Book Agency, New Delhi, 1999, viii+228 pp.

Articles published in refereed journals

6. *Some remarks concerning Voevodsky’s nilpotence conjecture* (with Marcello Bernardara, Goncalo Tabuada) to appear in *Journal für die reine angewandte Mathematik (Crelle)*
7. *Bost-Connes systems, Categorification, Quantum Statistical Mechanics, and Weil Numbers* (with Goncalo Tabuada) to appear in *Journal of Noncommutative Geometry*
8. *Twisted index theory on orbifold symmetric products and the fractional quantum Hall effect* (with Kyle Seipp) to appear in *Advances in Theoretical and Mathematical Physics*
9. *Spin Glass Models of Syntax and Language Evolution* (with Karthik Siva, Jim Tao) to appear in *Linguistic Analysis*
10. *Syntactic Phylogenetic Trees* (with Kevin Shu, Sharjeel Aziz, Vy-Luan Huynh, David Warrick) to appear in *International Journal of Geometric Methods in Modern Physics*
11. *Quantum statistical mechanics in arithmetic topology* (with Yujie Xu) *Journal of Geometry and Physics*, Vol. 114 (2017) 153–183.

12. *Syntactic Parameters and a Coding Theory Perspective on Entropy and Complexity of Language Families*, Entropy, Vol.18 (2016) N.4, 17 pages
13. *Semantic Spaces* (with Yuri Manin) Mathematics in Computer Science, Vol.10 (2016) N.4, 459–477
14. *Noncommutative numerical motives, Tannakian categories, and motivic Galois groups* (with Goncalo Tabuada), Journal of the European Mathematical Society (JEMS) 18 (2016), no. 3, 623–655.
15. *Spectral Action Models of Gravity on Packed Swiss Cheese Cosmology* (with Adam Ball) Classical Quantum Gravity 33 (2016), no. 11, 115018, 39 pages
16. *Symbolic dynamics, modular curves, and Bianchi IX cosmologies* (with Yuri Manin) Annales de la Faculté des Sciences de Toulouse, Vol. XXV (2016) N. 2–3, 313–338.
17. *KMS weights on higher rank buildings* (with Jake Marcinek) p-Adic Numbers Ultrametric Anal. Appl. 8 (2016), no. 1, 45–67.
18. *Rota-Baxter algebras, singular hypersurfaces, and renormalization in Kausz compactifications* (with Xiang Ni), Journal of Singularities, Vol.15 (2016) 80–117.
19. *Locality of gravitational systems from entanglement of conformal field theories* (with Jennifer Lin, Hiroshi Ooguri, Bogdan Stoica) Physical Review Letters, 114 221601 (2015)
(archive version “Tomography from Entanglement”, arXiv:1412.1879)
20. *From exceptional collections to motivic decompositions via noncommutative motives* (with Goncalo Tabuada) J. Reine Angew. Math. 701 (2015) 153–167.
21. *Spectral Action for Bianchi Type-IX Cosmological Models* (with Wentao Fan, Farzad Fathizadeh) J. High Energy Phys. 2015, no. 10, 085, front matter+28 pp.
22. *Graph Grammars, Insertion Lie Algebras, and Quantum Field Theory* (with Alex Port) Math. Comput. Sci. 9 (2015), no. 4, 391–408

23. *Potts models with magnetic field: arithmetic, geometry, and computation* (with Shival Dasu) *J. Geom. Phys.* 97 (2015), 14–24
24. *Entropy algebras and Birkhoff factorization* (with Nicolas Tedeschi) *J. Geom. Phys.* 97 (2015), 243–265
25. *Quantum computation and real multiplication* (with John Napp) *Mathematics in Computer Science*, 9 (2015), no. 1, 63–84.
26. *F-zeta geometry, Tate motives, and the Habiro ring* (with Catharine Wing Kwan Lo), *International Journal of Number Theory*, 11 (2015) N.2, 311–339.
27. *Algebraic renormalization and Feynman integrals in configuration spaces* (with Ozgur Ceyhan) *Advances in Theoretical and Mathematical Physics*, Vol.18 (2014) 469–511.
28. *Kolmogorov complexity and the asymptotic bound for error-correcting codes* (with Yuri Manin) *Journal of Differential Geometry*, Vol.97 (2014) 91–108.
29. *Big Bang, Blow up, and modular curves: algebraic geometry in cosmology* (with Yuri Manin) *SIGMA* 10 (2014), 073, 20 pages
30. *Noncommutative motives, numerical equivalence, and semi-simplicity* (with Goncalo Tabuada) *American Journal of Mathematics*, Vol.136 (2014) N.1, 59-75
31. *Noncommutative Artin motives* (with Goncalo Tabuada) *Selecta Mathematica*, Vol.20 (2014) N.1, 315-358.
32. *Jacobians of Noncommutative Motives* (with Goncalo Tabuada) *Moscow Mathematical Journal*, Vol.14 (2014) N.3, 577-594
33. *Coupling of gravity to matter, spectral action and cosmic topology* (with Branimir Cacic and Kevin Teh) *Journal of Noncommutative Geometry*, Vol.8 (2014) N.2, 473–504
34. *Thermodynamic Semirings* (with Ryan Thorngren) *Journal of Noncommutative Geometry*, Vol.8 (2014) N.2, 337–392

35. *Endomotives of Toric Varieties* (with Zhaorong Jin) Journal of Geometry and Physics, Vol. 77 (2014) 48-71
36. *Gauge Networks in Noncommutative Geometry* (with Walter van Suijlekom) Journal of Geometry and Physics, Vol.75 (2014) 71-91
37. *Multifractals, Mumford curves, and Eternal Inflation* (with Nicolas Tedeschi) p-Adic Numbers, Ultrametric Analysis and Applications, Vol.6 (2014) N.2, 135-154.
38. *Twisted spectral triples and quantum statistical mechanical systems* (with Mark Greenfield and Kevin Teh) p-adic Numbers, Ultrametric Analysis, and Applications, Vol.6 (2014) N.2, 81-104.
39. *A motivic approach to phase transitions in Potts models* (with Paolo Aluffi) Journal of Geometry and Physics, Vol.63 (2013) 6–31.
40. *Graph reconstruction and quantum statistical mechanics* (with Gunther Cornelissen) Journal of Geometry and Physics, Vol.72 (2013) 110–117.
41. *Quantum field theory over F_1* (with Dori Bejleri) Journal of Geometry and Physics, 69 (2013) 40–59.
42. *Asymptotic safety, hypergeometric functions and the Higgs mass in spectral action models* (with Christopher Estrada), International Journal of Geometric Methods in Modern Physics, Vol.10 (2013) N.7, 1350036 [30 pages]
43. *Arithmetic of Potts model hypersurfaces* (with Jessica Su) International Journal of Geometric Methods in Modern Physics Vol. 10, No. 4 (2013) 1350005 [22 pages]
44. *Noncommutative Mixmaster cosmologies* (with Christopher Estrada) International Journal of Geometric Methods in Modern Physics, Vol.10 (2013) N.1 [28 pages]
45. *Kontsevich’s noncommutative numerical motives* (with Goncalo Tabuada) Compositio Mathematica, Vol.148 (2012) N.6, 1811–1820.
46. *Feynman integrals and motives of configuration spaces* (with Ozgur Ceyhan) Communications in Mathematical Physics: Vol.313, N.1 (2012), Page 35–70.

47. *The coupling of topology and inflation in noncommutative cosmology* (with Elena Pierpaoli and Kevin Teh) Communications in Mathematical Physics, Vol.309 (2012) N.2, 341–369.
48. *Codes as fractals and noncommutative spaces* (with Christopher Perez) Mathematics in Computer Science, Vol.6 (2012) N.3, 199–215.
49. *The Ricci flow on noncommutative two-tori* (with Tanvir Ahamed Bhuyain) Letters in Mathematical Physics, Vol.101 (2012) N.2, 173–194.
50. *The spectral action and cosmic topology* (with Elena Pierpaoli and Kevin Teh) Communications in Mathematical Physics, 304 (2011) 125–174.
51. *Graph hypersurfaces and a dichotomy in the Grothendieck ring* (with Paolo Aluffi) Letters in Mathematical Physics, (2011) Vol.95, 223–232.
52. *Error-correcting codes and phase transitions* (with Yuri Manin) Mathematics in Computer Science, Vol.5 (2011) 133-170.
53. *Cuntz-Krieger algebras and wavelets on fractals* (with Anna Maria Paolucci) Complex Analysis and Operator Theory, Vol.5 (2011) N.1, 41-81.
54. *Algebro-geometric Feynman rules* (with Paolo Aluffi), International Journal of Geometric Methods in Modern Physics, Vol.8 (2011) N.1, 203–237.
55. *Building cosmological models via noncommutative geometry*, International Journal of Geometric Methods in Modern Physics, Vol.8, N.5 (2011) 1131–1168.
56. *Early Universe models from Noncommutative Geometry* (with Elena Pierpaoli) Advances in Theoretical and Mathematical Physics, Vol.14 (2010) 1373–1432.
57. *Parametric Feynman integrals and determinant hypersurfaces* (with Paolo Aluffi) Advances in Theoretical and Mathematical Physics, Vol.14 (2010) 911-963.
58. *Spin foams and noncommutative geometry* (with Domenic Denicola and Ahmad Zainy al-Yasry) Class. Quantum Grav. 27 (2010) 205025 (53pp)

59. *Boundary conditions of the RGE flow in the noncommutative geometry approach to particle physics and cosmology* (with Daniel Kolodrubetz) Physics Letters B 693 (2010) 166–174.
60. *Open string theory and planar algebras* (with Ozgur Ceyhan) J. Phys. A: Math. Theor. 43 (2010) 385401 (12pp)
61. *Cyclotomy and endomotives*, p-Adic Numbers, Ultrametric Analysis and Applications, Vol.1 (2009) N.3, 217-263.
62. *Feynman motives of banana graphs* (with Paolo Aluffi) Communications in Number Theory and Physics, Vol.3 (2009) N.1, 1-57.
63. *Fun with F_1* (with Alain Connes and Caterina Consani), Journal of Number Theory, Vol.129 (2009), N.6, 1532-1561.
64. *Solmanifolds and noncommutative tori with real multiplication*. Communications in Number Theory and Physics, Vol.2 (2008) No.2, 423–479.
65. *Supermanifolds from Feynman graphs*, (with Abhijnan Rej) Journal of Physics A, Vol.41 (2008) 315402 (21pp).
66. *Coverings, correspondences, and noncommutative geometry* (with Ahmed Zainy al-Yasry) Journal of Geometry and Physics, Vol.58 (2008) N.12, 1639-1661
67. *Zeta functions that hear the shape of a Riemann surface* (with Gunther Cornelissen) Journal of Geometry and Physics, Vol.58 (2008) N.5, 619-632.
68. *On the K -theory of graph C^* algebras* (with Gunther Cornelissen and Oliver Lorscheid) Acta Applicandae Mathematicae, Vol.102 (2008) N.1, 57–69.
69. *Noncommutative geometry and motives: the thermodynamics of endomotives*, (with Alain Connes and Caterina Consani), Advances in Mathematics, Vol.214 (2007) N.2, 761–831.
70. *Gravity and the Standard Model with neutrino mixing* (with Ali Chamseddine and Alain Connes), Advances in Theoretical and Mathematical Physics, 11 (2007) 991–1090.

71. *Quantum statistical mechanics over function fields* (with Caterina Consani) *Journal of Number Theory*, 123 (2007) 487–528.
72. *Quantum Fields and motives* (with Alain Connes), *Journal of Geometry and Physics*, Vol. 56 (2006) N.1, 55–85.
73. *Q-lattices: quantum statistical mechanics and Galois theory* (with Alain Connes), *Journal of Geometry and Physics*, Vol. 56 (2006) N.1, 2–23.
74. *KMS states and complex multiplication*, (with Alain Connes and Niranjan Ramachandran) *Selecta Math. (N.S.)* Vol.11 (2005) N.3-4, 325–347.
75. *Renormalization and motivic Galois theory* (with Alain Connes), *International Math. Research Notices* (2004) N.76, 4073–4092.
76. *Noncommutative geometry, dynamics, and ∞ -adic Arakelov geometry*, (with Caterina Consani), *Selecta Mathematica*, Vol.10 (2004) N.2, 167–251.
77. *Spectral triples from Mumford curves*, (with Caterina Consani), *International Math. Research Notices*, 36 (2003) 1945–1972.
78. *Limiting Modular symbols and the Lyapunov spectrum*, *Journal of Number Theory*, Vol.98 N.2 (2003) 348–376.
79. *The geometric triangle for 3-dimensional Seiberg-Witten monopoles*, (with Alan Carey and Bai-Ling Wang), *Communications in Contemporary Mathematics*, Vol.5 N.2 (2003) 197–250.
80. *Triplets spectraux en geometrie d'Arakelov*, (with Caterina Consani), *Comptes Rendus Acad. Sci. Paris, Ser. I* 335 (2002) 779–784.
81. *Weak UCP and perturbed monopole equations*, (with Bernhelm Booss-Bavnbek and Bai-Ling Wang), *International Journal of Mathematics*, Vol. 13 N.9 (2002) 987–1008.
82. *Seiberg-Witten and Casson-Walker invariant for rational homology spheres*, (with Bai-Ling Wang) *Geometriae Dedicata*, Vol.91 (2002), 45–58.
83. *Continued fractions, modular symbols, and noncommutative geometry*, (with Yuri Manin) *Selecta Mathematica, New Ser.* Vol.8 N.3 (2002) 475–520. (This paper got a Featured Review on the Mathematical Reviews: MR1931172)

84. *Holography principle and arithmetic of algebraic curves*, (with Yuri Manin), *Advances in Theoretical and Mathematical Physics*, Vol.5, N.3 (2001) 617–650.
85. *Equivariant Seiberg–Witten Floer homology*, (with Bai-Ling Wang), *Communications in Analysis and Geometry*, Vol.9 N.3 (2001) 451–639. (This paper got a Featured Review on the Mathematical Reviews: MR1895135)
86. *Twisted index theory on good orbifolds II: Fractional quantum numbers*, (with Varghese Mathai), *Communications in Mathematical Physics*, Vol.217 (2001) N.1 55–87.
87. *Twisted index theory on good orbifolds I: Noncommutative Bloch theory*, (with Varghese Mathai), *Communications in Contemporary Mathematics*, Vol.1 (1999) N.4, 553–587.
88. *Gauge groups and characteristic classes*, (with Mauro Spreafico), *Expositiones Mathematicae*, Vol.15 (1997) N.3, 229–249.
89. *Seiberg–Witten Floer homology and Heegaard splittings*, *International Journal of Mathematics*, 7 (1996) N.5, 671–696.
90. *Some remarks on conjugacy classes of bundle gauge groups*, *Cahiers Topologie Géom. Différentielle Catég.* 37 (1996) N.1, 21–39.
91. *Lorentz bundles*, *Rend. Inst. Mat. Univ. Trieste* 25 (1993) N.1-2, 309–315.

Refereed Book Chapters/Volume Contributions

92. *Feynman integrals and periods in configuration spaces* (with Ozgur Ceyhan), to appear in “Periods and Motives: Feynman amplitudes in the 21st century”, Clay Mathematical Institute and American Mathematical Society.
93. *Moduli Operad over F_1* (with Yuri Manin) in “Absolute arithmetic and F_1 geometry” (K.Thas, Ed.), pp. 331–364, European Mathematical Society, 2016.

94. *Information algebras and their applications*, in “Geometric science of information”, pp. 271–276, Lecture Notes in Comput. Sci., 9389, Springer, Cham, 2015.
95. *Unconditional noncommutative motivic Galois groups* (with Goncalo Tabuada), in “Hodge Theory and Classical Algebraic Geometry” (Editors: Gary Kennedy, Mirel Caibăr, Ana-Maria Castravet and Emanuele Macrì) pp. 109–115, Contemp. Math., Vol.647, Amer. Math. Soc., 2015.
96. *Noncommutative motives and their applications* (with Goncalo Tabuada) in “Commutative Algebra and Noncommutative Algebraic Geometry, I”, (Editors: David Eisenbud, Srikanth Iyengar, Anurag Singh, Toby Stafford, Michel Van den Bergh), pp. 191–214, MSRI Publications, Vol.67, Cambridge University Press, 2015.
97. *Dyson-Schwinger equations in the theory of computation* (with Colleen Delaney) in “Feynman amplitudes, periods and motives” (Editors: Luis Álvarez-Cónsul, José Ignacio Burgos Gil, Kurusch Ebrahimi-Fard), pp. 79–107, Contemp. Math., Vol.648, Amer. Math. Soc., 2015.
98. *Feynman motives and deletion-contraction relations* (with Paolo Aluffi) in “Topology of Algebraic Varieties and Singularities”, Contemporary Mathematics, Vol.538 (2011) 21-64, American Mathematical Society.
99. *Modular index invariants of Mumford curves* (with Alan Carey and Adam Rennie) in “Noncommutative Geometry, Arithmetic, and Related Topics”, Johns Hopkins University Press, 2011, pp.31-74.
100. *Motivic ideas in noncommutative geometry* (an appendix to Introduction to Motives, by R.Sujatha and J.Plazas) in “Noncommutative Geometry and Physics: Renormalisation, Motives, Index Theory”, European Mathematical Society, 2011, pp.61–87.
101. *Motivic ideas in physics* (an appendix to ”Motives: an introductory survey for physicists” by Abhijnan Rej) in “Combinatorics and Physics”, Contemporary Mathematics, Vol.539 (2011), pp.407–415, American Mathematical Society

102. *Noncommutative geometry and arithmetic* (ICM talk) Proceedings of the ICM-2010, Hyderabad, Vol.III, 2057-2077, World Scientific/Hindustan Book Agency, 2010.
103. *Feynman integrals and motives*, in “European Congress of Mathematics, Amsterdam 14-18 July 2008”, pp.293–332, European Mathematical Society, 2010.
104. *Motivic renormalization and singularities*, in “Quanta of Maths”, Clay Mathematics Institute, Vol.11 (2010) 409-458.
105. *The Weil proof and the geometry of the adèle class space*, (with Alain Connes and Katia Consani) in “Algebra, Arithmetic, and Geometry: in honor of Yu.I.Manin” Progress in Mathematics, Vol.270, Part I, Birkhauser 2009, 339-406.
106. *Modular shadows and the Levy-Mellin infinity-adic transform* (with Yuri Manin) in “Modular forms on Schiermonnikoog” (Eds. B.Edixhoven, G. van der Geer, B.Moonen) Cambridge University Press, 2008, pp. 189-238.
107. *A walk in the noncommutative garden* (with Alain Connes) in ”An invitation to Noncommutative Geometry”, pp.1-128, World Scientific, 2008.
108. *Noncommutative geometry on trees and buildings* (with Gunther Cornelissen, Kamran Reihani and Alina Vdovina), in “Traces in Geometry, Number Theory and Quantum Fields”, pp. 73-98, Vieweg Verlag, 2007.
109. *From Physics to Number Theory via Noncommutative Geometry. Part II: Renormalization, the Riemann–Hilbert correspondence, and motivic Galois theory* (with Alain Connes), in “Frontiers in Number Theory Physics and Geometry, II”, pp.617–713, Springer Verlag, 2006.
110. *KMS states and complex multiplication (part II)*, (with Alain Connes and Niranjana Ramachandran) in ”Operator Algebras”, pp.15–60, Springer Verlag, 2006.
111. *Modular curves, C^* -algebras, and chaotic cosmology*, in “Frontiers in Number Theory Physics and Geometry, II” pp.361–372, Springer Verlag, 2006.

- 112. *Archimedean cohomology revisited*, (with Caterina Consani), in “Noncommutative Geometry and Number Theory”, pp.109–140. Vieweg Verlag, 2006.
- 113. *Towards the fractional quantum Hall effect: a noncommutative geometry perspective* (with Varghese Mathai) in “Noncommutative Geometry and Number Theory”, pp.235–262. Vieweg Verlag, 2006.
- 114. *From Physics to Number Theory via Noncommutative Geometry. Part I: Quantum Statistical Mechanics of Q -lattices*, (with Alain Connes) in “Frontiers in Number Theory Physics and Geometry, I”, pp.269–350, Springer Verlag, 2006.
- 115. *Variants of equivariant Seiberg-Witten Floer homology*, (with Bai-Ling Wang), in “Spectral Geometry of Manifolds with Boundary and Decomposition of Manifolds”, Contemporary Mathematics, Vol. 366 (2005) 225–238.
- 116. *New perspectives in Arakelov geometry*, (with Caterina Consani), in “Number Theory”, CRM Lecture Notes, Vol. 36 (2004) 81–102.

Preprints

- 117. *Edge length dynamics on graphs with applications to p -adic AdS/CFT*, (with Steven S. Gubser, Matthew Heydeman, Christian Jepsen, Sarthak Parikh, Ingmar Saberi, Bogdan Stoica, Brian Trundy) arXiv:1612.09580
- 118. *Anyons in Geometric Models of Matter* (with Michael Atiyah) arXiv:1611.04047
- 119. *Periods and motives in the spectral action of Robertson-Walker spacetimes* (with Farzad Fathizadeh) arXiv:1611.01815
- 120. *Syntactic Structures and Code Parameters* (with Kevin Shu) arXiv:1610.00311
- 121. *Adinkras, Dessins, Origami, and Supersymmetry Spectral Triples* (with Nick Zolman), arXiv:1606.04463

- 122. *Tensor networks, p-adic fields, and algebraic curves: arithmetic and the AdS_3/CFT_2 correspondence* (with Matthew Heydeman, Ingmar Saberi, Bogdan Stoica), arXiv:1605.07639
- 123. *Modular forms in the spectral action of Bianchi IX gravitational instantons*, (with Wentao Fan, Farzad Fathizadeh) arXiv:1511.05321
- 124. *Prevalence and recoverability of syntactic parameters in sparse distributed memories* (with Jeong Joon Park, Ronnel Boettcher, Andrew Zhao, Alex Mun, Kevin Yuh, Vibhor Kumar) arXiv:1510.06342
- 125. *Persistent Topology of Syntax* (with Alexander Port, Iulia Gheorghita, Daniel Guth, John M. Clark, Crystal Liang, Shival Dasu) arXiv:1507.05134
- 126. *Quantum Statistical Mechanics, L-series and Anabelian Geometry* (with Gunther Cornelissen), arXiv:1009.0736

Other publications

Books edited

- 127. *Frobenius manifolds, quantum cohomology and singularities*, (with Claus Hertling, Editors), Vieweg Verlag, 2004.
- 128. *Noncommutative Geometry and Number Theory*, (with Caterina Conzani, Editors), Vieweg Verlag 2006.
- 129. *Traces in Geometry, Number Theory and Quantum Fields*, (with Sergio Albeverio, Sylvie Paycha, Jorge Plazas), Vieweg Verlag 2007.
- 130. *An invitation to Noncommutative Geometry*, (with Masoud Khalkhali), World Scientific, 2008.
- 131. *Arithmetic and Geometry around Quantization*, (with Özgür Ceyhan and Yuri Manin), Birkhäuser (to appear in 2009).
- 132. *Deformation Spaces*, (with Hossein Abbaspour and Thomas Tradler), Vieweg Verlag (to appear in 2010).
- 133. *Quantum groups and noncommutative geometry*, (with Deepak Parashar) Vieweg Verlag (to appear in 2010).

134. *Combinatorics and Physics*, (with Kurusch Ebrahimi-Fard and Walter van Suijlekom) Contemporary Mathematics, Vol.539, American Mathematical Society, 2011.

Popularization and non-refereed publications

135. *Lumen Naturae: visions of space in art and mathematics*, book to appear.
136. *A drifter of Dadaist persuasion*, in “Art in the Lives of Mathematicians” (Editor: Anna Kepes Szemerédi), pp. 223–244, American Mathematical Society, 2015.
137. *The Wolf and the Street: narrative encounters with Mathematics*, in “Imagine Math 3” (Editor: Michele Emmer) pp. 225–234, Springer Verlag, 2015.
138. *Mathematics as culture and knowledge*, in “Les Dechiffreurs”, Belin 2008.
139. *Noncommutative geometry and number theory*, in Nieuw Archief voor Wiskunde, (5) 9 (2008), no. 2, 109–112.
140. *Number theory in physics*, invited contribution to the “Encyclopaedia of Mathematical Physics” Elsevier.

Older unpublished manuscripts

141. *Dynamical systems on spectral metric spaces* (with Jean Bellissard and Kamran Reihani), arXiv:1008.4617
142. *Anomalies, Dimensional Regularization, and Noncommutative Geometry* (with Alain Connes), unfinished, available at <http://www.its.caltech.edu/~matilde/anomalies.pdf>
143. *Exact triangles in Seiberg-Witten-Floer theory, Part II: geometric limits of flow lines*, (with Bai-Ling Wang)
arXiv:math.DG/9907080 71 pages

144. *Exact triangles in Seiberg-Witten-Floer theory, Part III: the proof of exactness*, (with Bai-Ling Wang)
arXiv:math.DG/0009157. 69 pages
145. *Exact triangles in Seiberg-Witten Floer theory. Part IV: Z-graded monopole homology*, (with Bai-Ling Wang)
arXiv:math.DG/0009159. 34 pages
146. Система Обыкновенных Дифференциальных Уравнений Антисамодвойственных Связностей и Монополей Дирака,
MPI preprints 2002-40. 7 pages

Mathematical Activities

Invited Lecture Series

- 2015: three lectures at the “Geometry and Physics 2015” conference, Perimeter Institute for Theoretical Physics
- 2014: ten lectures and the Clay Institute Summer School “Periods and Motives: Feynman amplitudes in the 21st century”, ICMAT Madrid
- 2013: four lectures at the program “Mathematical Methods from Physics”, Kavli Institute for Theoretical Physics China, and Morningside Center, Beijing
- 2011: five lectures at “Geometry and Quantum Field Theory” school, Villa de Leyva
- 2011: three lectures at Perimeter Institute for Theoretical Physics
- 2011: Jose Adem Memorial Lecture Series, Cinvestav, Mexico City
- 2010: Series of three lectures, “Noncommutative geometry, Number Theory and Mathematical Physics”, Unam, Cuernavaca
- 2010: Minicourse on Arithmetic Noncommutative Geometry in the Master Class “Arithmetic Geometry and Noncommutative Geometry” Utrecht University

- 2008: Graduate Course “Noncommutative Geometry”, Florida State University
- 2007: Two lectures mini-course at CNRS Metz
- 2006: Two lectures in the school/workshop “Arithmetic and Geometry around Quantization”, Istanbul
- 2006: Three lectures at the Spring School on Noncommutative Geometry and Operator Algebras, Vanderbilt University
- 2005: Two lectures in the program “Mathematical structures of String Theory”, Kavli Institute for Theoretical Physics
- 2005: Series of two lectures at Bad Honnef Physics Center
- 2005: Series of three lectures at IPM Tehran.
- 2005: “Kempf Lectures”, Johns Hopkins University.
- 2005: Lecture Series (jointly with Alain Connes) at Vanderbilt University
- 2005: Three lectures at the “Masters Forum: Noncommutative Geometry” Fudan University, Shanghai
- 2004: Three lectures at the Banach Center, Polish Academy of Science and Warsaw University
- 2004: Two lectures at ISAS/SISSA and International Center of Theoretical Physics.
- 2004: Series of five lectures on “Noncommutative and arithmetic geometry” at the Spring School on Noncommutative Geometry and Operator Algebras, Vanderbilt University
- 2004: Series of four lectures on “Noncommutative Geometry and Number Theory”, CIRM Luminy
- 2003: Series of five lectures on “Noncommutative and arithmetic geometry”, University of Nottingham
- 2002: Series of four lectures on Noncommutative geometry, Fields Institute

Invited Talks

- 2016: invited speaker at “NSF Workshop: Geometry for Signal Processing and Machine Learning”, Estes Park, Colorado
- 2016: invited speaker at “Phylogenetic Models: Linguistics, Computation, and Biology”, Massachusetts Institute of Technology
- 2016: Plenary talk at “1st International Symposium on the Physics of Language”, Sophia University Tokyo
- 2015: Opening plenary lecture at the “2nd conference on Geometric Science of Information”, École Polytechnique
- 2015: Sectional talk at “2nd conference on Geometric Science of Information”, École Polytechnique
- 2015: Cosmology Seminar, Perimeter Institute for Theoretical Physics
- 2014: Seminar of Algebra, Geometry and Physics, Max Planck Institute for Mathematics
- 2014: Cosmology Seminar, Perimeter Institute for Theoretical Physics
- 2014: plenary talk, “String-Math 2014”, University of Alberta, Edmonton
- 2014: Noncommutative Geometry Seminar, Texas A&M
- 2014: Topology Seminar, Massachusetts Institute of Technology
- 2014: talk at Special Session “Singularities and Physics”, AMS meeting, Knoxville
- 2014: plenary talk at the 32nd Annual Western States Mathematical Physics Meeting
- 2013: Seminar of Algebra, Geometry and Physics, Max Planck Institute for Mathematics
- 2013, Plenary lecture, AMS Sectional Meeting, UC Riverside

- 2013, talk in the special session “Fractal Geometry” at the AMS Sectional Meeting, UC Riverside
- 2013, invited lecture at Tsinghua University Institute for Advanced Study, Beijing
- 2013, invited lecture at Beijing International Center for Mathematical Research, Beijing University
- 2013, lecture at the conference “Hodge Theory and Classical Algebraic Geometry” for Herb Clemens, Ohio State University
- 2013, MSRI-Evans Lecture, Berkeley
- 2013, talk at the workshop “Geometric perspectives in mathematical quantum field theory”, AIM, Palo Alto
- 2013, two lectures at the opening workshop of the program “Non-commutative Algebraic Geometry and Representation Theory”, MSRI, Berkeley.
- 2013, lecture at “AlbertoFest” conference in honor of the 70th birthday of Alberto Verjovksy, UNAM Cuernavaca
- 2012, “West Coast Operator Algebra Seminar”, University of Oregon
- 2012, talk in the conference “Fractal Geometry and Dynamical Systems”, UC Riverside
- 2012, talk at the “Midwest Topology Seminar”, Purdue University
- 2012, two lectures in the workshop “Novel approaches to the finite simple groups”, Banff
- 2012, talk in the workshop “Noncommutative Algebraic Geometry and its Applications to Physics”, Lorentz Center
- 2012, Colloquium Talk, University of Hawaii at Manoa
- 2011: plenary talk Strings-Math conference, U Penn
- 2011: Colloquium, Harvard University

- 2011: AMS National Meeting New Orleans, Session on “Mathematics Related to Feynman Diagrams”
- 2010: AMS meeting Notre Dame, Section “Number Theory and Physics”.
- 2010: Section ”Mathematical Physics”, ICM 2010, Hyderabad
- 2010: Workshop “Geometry and Quantum Field Theory”, Max Planck Institute for Mathematics
- 2010: Colloquium talk Georgiatech, Atlanta
- 2010: Workshop “Noncommutative Geometry and Loop Quantum Gravity”, Oberwolfach
- 2009: Meeting “Noncommutative Geometry and Cosmology”, IHES
- 2009: AMS Special Session “Algebraic Geometry”, UC Riverside
- 2009: AMS Special Session “Noncommutative Geometry”, UC Riverside
- 2009: Geometry and Physics Seminar, Northwestern University, USA.
- 2009: High Energy Physics Seminar, Florida State University, USA.
- 2009: Algebra Seminar, Florida State University, USA.
- 2009: Seminar Algebra Geometry and Physics, Max Planck Institute for Mathematics
- 2009: Conference “Noncommutative geometric methods in global analysis”, Hausdorff Center
- 2009: Workshop “Quantum fields, periods and polylogarithms”, IHES
- 2009: Conference “Geometry over F_1 , noncommutative geometry, and zeta”, Vanderbilt University
- 2009: JAMI conference, Johns Hopkins University
- 2009: Algebraic Geometry Seminar, MSRI
- 2009: Colloquium, U Michigan, Ann Arbor

- 2009: Geometry and Physics Seminar, U Michigan, Ann Arbor
- 2009: Mathematical Physics Meeting, Caltech
- 2009: Symplectic Geometry Seminar, UC Berkeley.
- 2008: Colloquium, University of Southern California
- 2008: Colloquium, UCLA
- 2008: Workshop “Random matrices and number theory”, Hausdorff Institute for Mathematics
- 2007: Colloquium, Caltech
- 2007: Mathematical Physics Seminar, Caltech
- 2007: lecture at International Center of Theoretical Physics
- 2007: Colloquium, Yale University
- 2007: Mathematical Physics Seminar, Yale University
- 2007: Symplectic Geometry Seminar, Courant Institute, NYU
- 2007: Special Section “Noncommutative Geometry and Arithmetic”, Sectional AMS meeting, New Brunswick
- 2007: Euler Fest, “Arithmetic Geometry” Conference, St. Petersburg
- 2007: Workshop “Trends in Noncommutative Geometry”, Northwestern University
- 2007: Spring School on Noncommutative Geometry and Operator Algebras, Vanderbilt University
- 2007: Colloquium Berkeley
- 2007: Number Theory Seminar, Berkeley
- 2007: Centre Physique Théoretique, Luminy
- 2007: Colloquium “Geometry and Quantum Physics Cluster”, Nijmegen

- 2007: lecture at Max Planck Institute for Mathematics in the Sciences
- 2006: lecture “Renormalization”, Max Planck Institute for Mathematics
- 2006: Colloquium, University of Rome II
- 2006: Colloquium, Freiburg University
- 2006: lecture at Renyi Institute
- 2006: Centre Physique Théoretique, Luminy
- 2006: Noncommutative Geometry Conference, Banff
- 2006: Operator Algebra Seminar, University of Oslo
- 2006: Operator Algebra Seminar, University of Trondheim
- 2006: Colloquium, University of Trondheim
- 2006: Mathematical Sciences Institute, Australian National University, Canberra
- 2005: Department of Mathematics, University of Milan
- 2005: lecture at Lorentz Center
- 2005: lecture at Max Planck Institute for Mathematics in the Sciences
- 2005: Lecture at Max Planck Institute for Mathematics
- 2005: Lecture in the “Giornata INdAM”, Napoli
- 2005: The 3rd Annual Spring Institute on Noncommutative Geometry and Operator Algebras, Vanderbilt University
- 2005: Centre de Physique Théorique, Luminy
- 2005: Lecture at Institut de Mathématiques de Luminy
- 2004: Mathematical Physics Seminar, ETH Zurich
- 2004: lecture at Oberwolfach

- 2004: Lecture at Abel Symposium
- 2004: Seminar Algebraic Structures in Quantum Field Theory, Florida State University
- 2004: Algebra Seminar, Florida State University
- 2004: lecture at CIRM Luminy
- 2004: Geometric Analysis Seminar, Laboratoire Emile Picard, Université Paul Sabatier, Toulouse
- 2004: Stochastics Seminar, University of Bonn
- 2004: lecture “Arithmetic and algebraic geometry”, University of Padua
- 2003: Algebra Seminar, Florida State University
- 2003: Lecture at CIRM Luminy
- 2003: Lecture at Mittag–Leffler Institute
- 2003: Lecture at Max Planck Institute for Mathematics
- 2003: Number Theory Seminar, University of Utrecht
- 2003: Lecture at the Les Houches
- 2003: Cambridge-Oxford-Warwick Seminar in Algebraic Geometry
- 2003: Colloquim Lecture, University of California Berkeley
- 2003: Lecture at the AMS National meeting, special session “Computational algebraic and analytic geometry for low dimensional varieties”, Baltimore
- 2003: Lecture at the AMS National meeting, special session “Primes and knots”, Baltimore
- 2002: Geometric Mathematical Physics Seminar, Aarhus University
- 2002: Topology Seminar, Aarhus University
- 2002: Lecture at Polish Academy of Science, Warsaw,

- 2002: Colloquium Lecture, University of Toronto
- 2002: Colloquium Lecture, Florida State University
- 2002: Lecture “Geometric properties of real and complex manifolds”,
Palermo
- 2002: Lecture at Greifswald University
- 2002: Algebraic Geometry Seminar, Université de Rennes I
- 2002: Colloquium Lecture, Münster University
- 2002: Analysis Seminar, Roskilde University
- 2001: Number Theory Seminar, Max Planck Institute for Mathematics
- 2001: Algebraic Geometry seminar, University of Toronto
- 2001: University of Helsinki
- 2001: Lecture at CRM Montreal
- 2001: Lecture at Scuola Normale Superiore, Pisa
- 2001: Colloquium Lecture, Regensburg University
- 2001: Colloquium Lecture, Bielefeld University
- 2001: Seminar on Algebra, Geometry and Physics, Max Planck Institute for Mathematics
- 2001: Colloquium Lecture, Bonn University
- 2001: Colloquium Lecture, Göttingen University
- 2001: Differential Geometry Seminar, Bonn University
- 2001: Lecture at International Center of Theoretical Physics
- 2000: Topology seminar, Trinity College, Dublin
- 2000: Lecture at Max Planck Institute for Mathematics in the Sciences

- 2000: Seminar on Algebra, Geometry and Physics, Max Planck Institute for Mathematics
- 2000: Lecture at the EURESCO conference “Mathematical Analysis”, Castelvechio Pascoli
- 2000: Two lectures “gauge theory and calibrated geometry”, Martina Franca
- 2000: Gauge Theory Seminar, Harvard University
- 1999: Mathematical Physics Seminar, Harvard University/MIT
- 1999: Topology seminar, Yale University
- 1999: Geometry seminar, University of Illinois at Urbana Champaign
- 1999: Lecture at the sectional AMS meeting, Special Session “Gauge Theory”, Charlotte NC
- 1999: Lecture at the sectional AMS meeting, Special Session “Index theory”, Austin
- 1999: Lecture “Geometric properties of real and complex manifolds”, Palermo
- 1999: Oberseminar Topology, Max Planck Institute for Mathematics
- 1999: Geometry Seminar, Florida State University
- 1999: Lecture at Tata Institute of Fundamental Research
- 1998: Oberseminar Topology, Max Planck Institute for Mathematics
- 1998: Topology Seminar, Stanford University
- 1997: Lecture at the Joint Meeting of the Mexican Mathematical Society and of the American Mathematical Society, Oaxaca
- 1997: Ohio State University
- 1997: Lecture at the Topical Workshop in Geometry and Physics, Center for the Subatomic Structure of Matter, University of Adelaide

- 1997: Geometry Seminar, University of Adelaide
- 1997: Lecture at the Workshop on 4-dimensional manifolds, MSRI
- 1996: Stanford University
- 1995: University of Bielefeld
- 1993: Lecture at the International Conference of Topology, International Center of Theoretical Physics
- 1992: Lecture at the Workshop on Measure Theory and Real Analysis, Grado

Conferences organized

1. Conference “Geometrical and topological structures of information”, CIRM Luminy, 2017.
2. Workshop “Algebraic and Geometric Deformation Spaces”, Max Planck Institute for Mathematics, 2008 (co-organized with Hossein Abbaspour and Thomas Tradler).
3. Workshop “The manifold geometries of quantum field theory”, Max Planck Institute for Mathematics, 2008 (co-organized with Sergio Albeverio and Hanno Gottschalk).
4. Winter School and Workshop “Moduli Spaces” Max Planck Institute for Mathematics, 2008 (co-organized with C.F.Bödigheimer, Yu.I.Manin, U.Tillmann).
5. International School and Conference of Noncommutative Geometry, Chern Institute Nankai University, Tianjin, PR China August 15-30, 2007. (co-organized with Guihua Gong and Guoliang Yu).
6. Workshop “Quantum Groups and Noncommutative Geometry”, Max Planck Institute for Mathematics, 2007 (co-organized with Deepak Parashar).
7. Workshop “Hochschild and Cyclic (co-)homology and Applications to Geometry and Physics” Max Planck Institute for Mathematics, 2007 (co-organized with Hossein Abbaspour).

8. Alain Connes 60th birthday conference IHES/IHP, 2007 (co-organized with Henri Moscovici and Georges Skandalis)
9. Workshop “Combinatorics and Physics” Max Planck Institute for Mathematics, 2007. (co-organized with Kurusch Ebrahimi-Fard and Walter van Suijlekom)
10. Workshop “Renormalization”, Max Planck Institute for Mathematics, 2006. (co-organized with Kurusch Ebrahimi-Fard)
11. “Fourth Annual Spring Institute on Noncommutative Geometry and Operator Algebras”, Vanderbilt University, 2006. (co-organized with Dietmar Bisch, Alain Connes, Bruce Hughes, Gennadi Kasparov, and Guoliang Yu).
12. “Traces in Geometry, Number Theory, and Quantum Fields”, Max Planck Institute for Mathematics, 2005. (co-organized with Sergio Albeverio, Sylvie Paycha)
13. “International workshop on Noncommutative Geometry”, school and workshop, IPM 2005 (co-organized with Masoud Khalkhali, Shahin S. Jabbari, Mehrdad Mirshams Shahshahani).
14. “Arithmetic Geometry and High Energy Physics”, Lorenz Center, 2005 (co-organized with Gunther Cornelissen and Andrew Waldron).
15. “Yuri Manin’s Emeritierung Conference”, Max Planck Institute for Mathematics 2005 (co-organized with Ivan Penkov and Don Zagier).
16. “Workshop on Noncommutative geometry and Number Theory, II”, Max Planck Institute for Mathematics 2004 (co-organized with A.Connes, C.Consani, and Yu.Manin).
17. “Workshop on Noncommutative geometry and Number Theory”, Max Planck Institute for Mathematics 2003 (co-organized with C.Consani and Yu.Manin).
18. “Frobenius manifolds, singularities, and quantum cohomology”, Max Planck Institute for Mathematics 2002 (co-organized with B. Dubrovin, C. Hertling, Yu. Manin, K. Saito).

19. “Maass wave forms, Selberg zeta function, and Spin chains” Max Planck Institute for Mathematics 2002 (co-organized with J. Lewis and D. Zagier).

Students currently or previously supervised

Former students:

- Eugene Ha (PhD 2006) “Quantum Statistical Mechanics of Shimura varieties”
- Jorge Plazas Vargas (PhD 2007) “Arithmetic structures on noncommutative tori with real multiplication”
- Snigdhasyan Mahanta (PhD 2007) “Algebraic aspects of Noncommutative Tori: the Riemann–Hilbert correspondence”
- Ivan Dynov (PhD 2008) “Type III von Neumann Algebras in the Theory of Infinite-Dimensional Groups”.
- Ahmed Zainy al-Yasry (PhD 2008) “Coverings, Correspondences, and Noncommutative Geometry”.
- Bram Mesland (PhD 2009) “Bivariant K-theory of Groupoids and the Noncommutative Geometry of Limit Sets”.
- Rafael Torres (PhD 2010) “Geography and Botany of Irreducible Symplectic 4-manifolds with Abelian Fundamental Group”
- Ali Shojaei-Fard (PhD 2010) “Riemann-Hilbert Problem and Quantum Field Theory: Integrable Renormalization, Dyson-Schwinger Equations”.
- Majid Heydarpour (PhD 2010) “Green Functions on the Boundary at Infinity of Hyperbolic 3-manifolds”
- Tobias Fritz (PhD 2010) “Contributions to Quantum Probability”
- Dapeng Zhang (PhD 2011) “Projective Dirac operators, twisted K-theory and local index formula”
- Nikolay Ivankov (PhD 2011) “Unbounded bivariant K-theory and an approach to noncommutative Frechet spaces”

- Dan Li (PhD 2012) “Periods and motives: applications in Mathematical Physics”
- Christopher Duston (PhD 2012) “Exotic smoothness, branched covering spaces and quantum gravity”
- Branimir Ćaćić (PhD 2013) “On reconstruction theorems in noncommutative Riemannian geometry”
- Kevin Teh (PhD 2013) “Dirac spectra, summation formulae, and the spectral action”
- Victor Kasatkin (PhD 2015) “Some constructions related to noncommutative tori, Fredholm modules and the Beilinson-Bloch regulator”
- Xiang Ni (PhD 2016) “Rota-Baxter Algebras, Renormalization on Kausz Compactifications and Replicating of Binary Operads”

Current PhD students:

- Joshua Leiber (Caltech)
- Emad Nasrollahpoursamani (Caltech)
- Thomas Norton (Caltech)
- Jane Panangaden (Caltech)
- Yunyi Shen (FSU)
- James Tao (Caltech)

Teaching Experience

Courses taught:

- Geometry of Neuroscience (Caltech 2017)
- Mathematical and Computational Linguistics (Caltech 2015)

- Geometry and Physics of Information Theory (Caltech 2014, 2016, 2017)
- The Geometry of Quantum States (Caltech 2012)
- Motives and Quantum Field Theory (Caltech 2014)
- Motives and Periods (Caltech 2014)
- Quantum Statistical Mechanics in Number Theory (Caltech 2016)
- Arithmetic and Geometry of Quantum Fields (Caltech 2008)
- Noncommutative Geometry (FSU 2008, Caltech 2009, 2011)
- Noncommutative Geometry Models for Particle Physics and Cosmology (Caltech 2016)
- Chaos Theory and Fractal Geometry (Caltech 2011, 2014, 2017)
- Analysis on manifolds (MIT 1999)
- Calculus (University of Chicago, 1995, 1996, 1997, Caltech 2011)
- Topology (MIT 1998)
- Morse theory and Floer theory (MIT 1998)
- Differential Equations (Caltech 2010, 2012, 2014)
- Differential Geometry (MIT 2000)
- Riemann Surfaces (MIT 2000)
- Sanskrit for Modern Scientists (Caltech 2011)

Refereeing

- Served as referee for the following journals: Acta Mathematica, Annals of Mathematics, Central European Journal of Mathematics, Communications in Analysis and Geometry, Communications in Contemporary Mathematics, Communications in Mathematical Physics, Communications in Number Theory and Physics, Conformal Geometry and Dynamics, Contemporary Mathematics, Crelle, Documenta Mathematica, Entropy, Functional Analysis, IMRN, Inventiones, Journal of the AMS, Journal of Geometry and Physics, Journal of High Energy Physics, Journal of Mathematical Physics, Journal of Noncommutative Geometry, Journal of Number Theory, Journal of Physics A, Letters in Mathematical Physics, Mathematical Proceedings Cambridge Philosophical Society, New Journal of Physics, Pacific Journal of Mathematics, Sociological Methods and Research, Topology, Topology and its Applications, Transactions of the American Mathematical Society.
- Served as referee for: NSF grant proposals under the programs Algebra and Number Theory, Applied Mathematics and Mathematical Physics, Mathematical Physics, Geometric Analysis, Topology; Minerva Stiftung grant proposals Junior Research Group; Volkswagen Stiftung grants.