

Curriculum Vitae

Daniel Ruberman, Professor of Mathematics

Academic Address

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Education

1977 BA/MA, Wesleyan University
1982 Ph.D., University of California, Berkeley

Career

1982-84 Courant Instructor, Courant Institute, New York University
1984-85 Fellow, Mathematical Sciences Research Institute, Berkeley
1985-88 Assistant Professor, Brandeis University
1988-95 Associate Professor, Brandeis University
1991-92 Visiting Scholar, Harvard University
1994-95 Visiting Scholar, Mathematical Institute, Oxford
1995- Professor, Brandeis University
1998-2000 Chairman, Department of Mathematics, Brandeis University
2000-2001 Chercheur Invité, Université de Paris Sud, Orsay
2001 Member, Institut des Hautes Études Scientifiques, Bures-sur-Yvette
Fall 2010 Visiting Scholar, Kyoto University
Winter 2011 Visiting Scholar, MIT
Spring 2011 Chercheur Invité, University de Paris 7
2014-2017 Chairman, Department of Mathematics, Brandeis University
March 2015 Visiting Fellow, Indiana University Institute for Advanced Study
Fall 2017 Visiting Scholar, University of Pisa
Spring 2018 Visiting Scholar, Stanford University
Fall 2022 Research Professor, Mathematical Sciences Research Institute, Berkeley
Spring 2023 Distinguished Visiting Professor, Kyoto University
Spring 2023 Visiting Scholar, Tokyo University

Honors and Grants

1990- NSF Research Grant in Topology (PI)
1987-90 NSF Mathematical Sciences Postdoctoral Research Fellow
1991-92 Sloan Foundation Fellow
1994-95 EPSRC Grant, supporting visit to Mathematical Institute, Oxford
2000-01 CNRS Grant, supporting visit to University of Paris, Orsay
2006-08 Slovenian/US Grant, supporting visit to University of Ljubljana, Slovenia
2006-15 Department of Education GAAAN grant (PI)
2011 CNRS Grant, supporting visit to University of Paris 7
2011-15 NSF FRG Grant: *The topology and invariants of smooth 4-manifolds* (co-PI)
2011-15 NSF IGERT Grant: *Geometry and Dynamics – Integrated Education in the Mathematical Sciences* (co-PI)
2015-17 American Institute for Mathematics SQuaRE (co-PI)
2016 Fellow of the American Mathematical Society
2017-18 Simons Fellow in Mathematics
2020-24 NSF FRG Grant: *Collaborative research in gauge theory* (co-PI)
2023-25 American Institute for Mathematics SQuaRE (co-PI)

Professional Service

1995–2002	Associate Editor for Research Reports, Bulletin of the AMS
2005	Visiting Committee for Graduate Program in Mathematics, Northeastern University.
2004–2006	American Mathematical Society Centennial Fellowship Committee (Chair 2005–2006)
2006–2014	Editorial Board, Proceedings of the AMS; Coordinating Editor for Geometry & Topology, 2010–2014.
2006–	Editorial Board, Gökova Geometry/Topology Journal.
2008	Co-organizer of conference, <i>Knot concordance: Fifty Years since Fox and Milnor</i> .
2011	Co-organizer of AMS special session, <i>Gauge Theory and Low-dimensional Topology</i> .
2012	Organized FRG Workshop, <i>Group actions on 4-manifolds</i> .
2013	Co-organizer of special session, <i>47th Spring Topology and Dynamics Conference</i> .
2013	Co-organizer, <i>Group actions on smooth 4-manifolds</i> , University of Massachusetts.
2014	Co-organizer, <i>Workshop on Topology and Invariants of 4-Manifolds</i> , Simons Center.
2015	Co-organizer, <i>Geometry and topology of symplectic 4-manifolds</i> , University of Massachusetts.
2017	Co-organizer, <i>Floer homologies and topology of 4-manifolds</i> , University of Massachusetts.
2017	Co-organizer, <i>Thirty years of Floer theory for 3-manifolds</i> , Casa Matemática Oaxaca.
2017	Co-organizer, <i>Low Dimensional Topology and Gauge Theory</i> , Casa Matemática Oaxaca.
2018	Co-organizer, <i>Workshop on symplectic four-manifolds through branched coverings</i> , AIM.
2018	Co-organizer, <i>Workshop on Knotted surfaces in 4-manifolds</i> , University of Massachusetts.
2021	Co-organizer, AMS special session, <i>Gauge Theory, Geometry, and Low-Dimensional Topology</i> .
2021	External Review Committee for Computer Science & Mathematics, Wesleyan University.
2022–2025	American Mathematical Society Fellow Selection Committee.
2023	Co-organizer, <i>K3: A new problem list in low-dimensional topology</i> , AIM.

Publications of Daniel Ruberman

1. *Exotic families of embeddings* (with Dave Auckly). *Frontiers in Geometry and Topology* (L. Ng and P. Ozsváth, Peter), published in the AMS Proceedings of Symposia in Pure Mathematics series. (2023).
2. *Equivariant hyperbolization of 3-manifolds via homology cobordisms* (with D. Auckly, H. Kim, and P. Melvin). *Top. Appl.* (2023) <https://doi.org/10.1016/j.topol.2023.108485>.
3. *Wall's stable realization for diffeomorphisms of definite 4-manifolds (with Sašo Strle)*. *Indiana U. Math. Jour.*, to appear (2023). <https://arxiv.org/abs/2210.16260>.
4. *On positive scalar curvature cobordisms and the conformal Laplacian on end-periodic manifolds* (with D. Kazaras and N. Saveliev). *Comm. Anal. Geom.*, **30** No. 4, 869–890 (2022) <http://arxiv.org/abs/1902.00443>
5. *On the Thom conjecture in \mathbf{CP}^3* (with Marko Slapar and Sašo Strle). *International Math. Res. Notices*, <https://doi.org/10.1093/imrn/rnab343>, to appear. <https://arxiv.org/abs/2109.05089>
6. Applications of Instanton Floer homology (with Juanita Pinzón-Cañedo). *Notices of the AMS*, 1307–1319, September 2022. <https://www.ams.org/journals/notices/202208/rnoti-p1307.pdf>
7. *On the spectral sets of Inoue surfaces* (with N. Saveliev). In *Gauge theory and low-dimensional topology: progress and interaction*, edited by J. Baldwin, H. Boden, J. Etnyre, and L. Watson. *Open Book Series 5* (2022), 285–297 Mathematical Sciences Publishers, Berkeley, 2020. <https://doi.org/10.2140/obs.2022.5.285>.
8. *A Levine-Tristram invariant for knotted tori*. *Algebraic & Geometric Topology*, **22** (2022) 2395–2418. <https://arxiv.org/abs/2010.02355>.
9. *On the Frøyshov invariant and monopole Lefschetz number* (with J. Lin and N. Saveliev). *J. Diff. Geom.*, **123** (2023), 523 – 593. DOI: 10.4310/jdg/1683307008, <http://arxiv.org/abs/1802.07704>.
10. *On the monopole Lefschetz number of finite order diffeomorphisms* (with J. Lin and N. Saveliev). *Geometry & Topology*, 25–7 (2021), 3591–3628. DOI 10.2140/gt.2021.25.3591. <https://arxiv.org/abs/2004.05497>.
11. *Harmonic spinors on the Davis hyperbolic 4-manifold* (with J. Ratcliffe and S. Tschantz). *J. Topology and Analysis*, **13** No. 03 (2021), 699 - 737. <https://arxiv.org/abs/1803.06382>.
12. *Topological spines of 4-manifolds* (with H. Kim). *Algebraic & Geometric Topology*, **20** (2020) 3589–3606. <http://arxiv.org/abs/1905.03608>

13. *Isotopy of surfaces in 4-manifolds after a single stabilization* (with D. Auckly, H. J. Kim, P. Melvin, and H. Schwartz). *Adv. Math.*, **341** (2018), 609–615. <https://arxiv.org/abs/1708.03208>.
14. *A splitting theorem for the Seiberg-Witten invariant of a homology $S^1 \times S^3$* (with J. Lin and N. Saveliev). *Geometry & Topology*, **22** (2018), no. 5, 2865–2942. <https://arxiv.org/abs/1702.04417>.
15. *Heegaard Floer invariants in codimension one* (with A. Levine). *Trans. Amer. Math. Soc.*, **371**, No. 5, (2017): 3049–3081. <https://arxiv.org/abs/1610.03353>.
16. *Topological realizations of line arrangements* (with L. Starkston). *International Math. Res. Notices*, rnx190 (2018). <https://doi.org/10.1093/imrn/rnx190>; <http://arxiv.org/abs/1606.01776>.
17. *Four-dimensional analogues of Dehn’s lemma* (with A. Ray). *J. London Math. Soc. (2)* **96** (2017) 111–132. <https://arxiv.org/abs/1608.08654>.
18. *Equivariant Corks* (with D. Auckly, H. Kim, P. Melvin). *Algebraic & Geometric Topology*, **17** (2017), 1771–1783. <http://arxiv.org/abs/1602.07650>.
19. *On smoothly slice knots*. *New York J. Math.* **22** (2016), 711–714. <http://arxiv.org/abs/1601.03453>.
20. *Absolutely exotic compact 4-manifolds* (with S. Akbulut). *Comment. Math. Helv.*, **91**, No. 1 (2016), 1–19. <http://arxiv.org/abs/1410.1461>.
21. *An index theorem for end-periodic operators* (with T. Mrowka and N. Saveliev). *Compositio Math.*, **152** No. 2 (2016), 399–444. <http://arxiv.org/abs/1105.0260>.
22. *Stable isotopy in four dimensions* (with D. Auckly, H. J. Kim, and P. Melvin). *Journal of the London Math. Soc.*, **91** (2015), 439–463. doi:10.1112/jlms/jdu075.
23. *Non-orientable surfaces in homology cobordisms* (with A. Levine and S. Strle, and appendix by I. Gessel). *Geometry & Topology* **19** (2015) 439–494. <http://arxiv.org/abs/1310.8516>.
24. *Casson-type invariants from the Seiberg-Witten equations* (with N. Saveliev); In *New ideas in low dimensional topology*, *New ideas in low dimensional topology*, Kauffman, L., Manturov, V., editors. Ser. Knots Everything **56** World Sci. Publ., Hackensack, NJ, 2015. 507–524. <http://arxiv.org/abs/1303.2273>.
25. *Index theory of the de Rham complex on manifolds with periodic ends* (with T. Mrowka and N. Saveliev). *Algebraic & Geometric Topology*, **14** (2014) 3689–3700. <http://arxiv.org/abs/1310.4246>.
26. *Generalized Heegaard Floer correction terms* (with A. Levine); *Proceedings of the Gökova Geometry-Topology Conference 2013*, (2014) 76–96.
27. *Concordance properties of parallel links* (with S. Strle), *Indiana Univ. Math. J.* **62** (2013), 799–814 <http://arxiv.org/abs/1108.4476>.
28. *Topologically slice knots with nontrivial Alexander polynomial* (with C. Livingston and M. Hedden), *Adv. Math.*, **231** (2012) 913–939; <http://arxiv.org/abs/1001.1538>.
29. *Concordance to links with unknotted components* (with J. C. Cha), *Algebraic & Geometric Topology*, **12** (2012) 963–977; <http://arxiv.org/abs/1103.2417>.
30. *Double point surgery and configurations of surfaces* (with H. J. Kim), *Journal of Topology* **4** (2011), 573–590; <http://arxiv.org/abs/1001.3750>.
31. *Seiberg-Witten equations, end-periodic Dirac operators, and a lift of Rohlin’s invariant* (with T. Mrowka and N. Saveliev), *J. Diff. Geom.* **88**, No. 2 (2011), 333–377; <http://arxiv.org/abs/0905.4319>.
32. *Smooth concordance of links topologically concordant to the Hopf link* (with J. C. Cha, T. Kim and S. Strle), *Bull. Lond. Math. Soc.*, **44** No. 3 (2012) (2012) 443–450; <http://arxiv.org/abs/1012.2045>.
33. *The $\bar{\mu}$ -invariant of Seifert fibered homology spheres and the Dirac operator* (with N. Saveliev), *Geom. Dedic.* **154**, Issue 1, (2011), 93–101; <http://arxiv.org/abs/1009.3201>
34. *Smooth surfaces with non-simply-connected complements* (with H.-J. Kim), *Algebraic & Geometric Topology* **8** (2008) 2263–2287. DOI: 10.2140/agt.2008.8.2263
35. *Knot concordance and Heegaard Floer homology invariants in branched covers* (with E. Grigsby and S. Strle). *Geometry and Topology*, **12** (2008), no. 4, 2249–2275. <http://www.arxiv.org/abs/math.GT/0701460>.
36. *Algebraic and Heegaard-Floer invariants of knots with slice Bing doubles* (with J. C. Cha and C. Livingston). *Math. Proc. Camb. Phil. Soc.*, **144**, No. 2 (2008), 403–410. <http://www.arxiv.org/abs/math.GT/0612419>.
37. *Topological triviality of smoothly knotted surfaces in 4-manifolds* (with H.-J. Kim), *Trans. Amer. Math. Soc.*, **360** (2008), no. 11, 5869–5881.

38. *Dirac operators on manifolds with periodic ends* (with N. Saveliev). *Gökova Geometry and Topology Journal*, **1** (2007). 33-50. <http://gokovagt.org/journal/2007/jggt07-rubesave.pdf>.
39. *Rohlin's invariant and gauge theory III. Homology 4-tori* (with N. Saveliev), *Geometry and Topology*, **9** (2005) Paper no. 47, pages 2079-2127.
40. *Casson-type invariants in dimension four* (with N. Saveliev), *Proceedings of the Fields-McMaster Conference on Geometry and Topology of Manifolds*. *Fields Institute Communications* **47** (2005), 281-306. <http://arxiv.org/abs/math.GT/0501090>.
41. *Rohlin's invariant and gauge theory, I: Homology 3-tori* (with N. Saveliev), *Comm. Math. Helv.*, **9** (2004), no. 3, 618-646. <http://arxiv.org/math.GT/0302131>.
42. *Rohlin's invariant and gauge theory, II: Mapping tori* (with N. Saveliev), *Geometry and Topology*, **8** (2004) Paper no. 2, pages 35-76.
43. *Isospectrality and 3-manifold groups*, *Proc. Amer. Math. Soc.* **129** (2001), 2467-2471.
44. *Positive scalar curvature, diffeomorphisms, and the Seiberg-Witten equations.*, *Geometry and Topology*, Vol. 5 (2001) Paper no. 28, pages 895-924.
45. *Mod 2 Seiberg-Witten invariants of homology tori*, (with Sašo Strle), *Math Res. Lett.*, **7** (2000), no. 5-6, 789-799.
46. *Embedding tangles in links*, *J. Knot Theory Ramif.* **9** (2000), no. 4, 523-530.
47. *A polynomial invariant of diffeomorphisms of 4-manifolds*, *Geometry and Topology Monographs* **2** (1999), 473-487.
48. *Mutation and gauge theory. I. Yang-Mills invariants*, *Comment. Math. Helv.* **74** (1999), no. 4, 615-641.
49. *An obstruction to smooth isotopy in dimension 4*, *Math. Res. Lett.* **5** (1998), 743-758.
50. *A sextic surface cannot have 66 nodes* (with D. Jaffe), *J. Alg. Geom.* **6** (1997), 151-168.
51. *Null-homotopic embedded codimension-one spheres*, pages 229-232 in "Tight and taut submanifolds," Cambridge Univ. Press, Cambridge (1997).
52. *A fake $\mathbf{CP}^2 \# \mathbf{RP}^4$* (with R. Stern), *Math. Res. Lett.* **4** (1997), 375-378.
53. *Relations among Donaldson invariants arising from negative 2-spheres and tori*, *Duke Math. J.* **83** (1996), 645-660.
54. *Configurations of 2-spheres in the K3 surface and other 4-manifolds*, *Math. Proc. Camb. Phil. Soc.* **120** (1996), 247-253.
55. *The minimal genus of an embedded surface of non-negative square in a rational surface*, *Turkish J. Math.* **20** (1996), 129-133.
56. *Involutions on spin 4-manifolds*, *Proc. Amer. Math. Soc.* **123** (1995) 593-597.
57. "The L^2 moduli space and a vanishing theorem for Donaldson's Polynomial invariants" (with J. Morgan and T. Mrowka), *Monographs in Geometry and Topology*, International Press (1994).
58. *Splitting the spectral flow, and the Alexander matrix* (with P. Kirk and E. Klassen), *Comm. Math. Helv.* **69** (1994), 375-416.
59. *Smooth 2-spheres in homology K3 surfaces*, *Top. Appl.* **59** (1994), 1987-99.
60. *Homology and bounded homology of universal covers.* (Appendix to *Manifolds with wells of negative Ricci curvature*, by S. Rosenberg and K. D. Elworthy), *Invent. Math.* **103** (1991), 491-496.
61. *Cutting and pasting and the η -invariant* (with R. Meyerhoff), *Duke Math. J.* **61** (1990), 747-762.
62. *Mutation and the η -invariant* (with R. Meyerhoff), *J. Diff. Geom.* **31** (1990), 101-130.
63. *Seifert surfaces of knots in S^4* , *Pacific J. Math.* **145** (1990), 97-116.
64. *Invariants of tangles* (with T. Cochran), *Math. Proc. Camb. Phil. Soc.* **105** (1989), 299-306.
65. *Rational homology cobordisms of rational space forms*, *Topology* **27** (1988), 401-414.
66. *Imbeddings and homology cobordisms of lens spaces* (with S. Cappell) *Comm. Math. Helv.* **63** (1988), 75-89.
67. *The Casson-Gordon invariants in high-dimensional knot theory*, *Trans. AMS* **306** (1988), 579-595.
68. *Mutation and volumes of knots in S^3* , *Invent. Math.* **90** (1987), 189-215.
69. *Concordance of links in S^4* , *Contemporary Math.* **35** (Four Manifold theory) (1984), 481-483.
70. *Invariant Knots of free involutions of S^4* , *Top. Appl.* **18** (1984), 217-224.
71. *Doubly slice knots and the Casson-Gordon invariants*, *Trans. Amer. Math. Soc.* **279** (1983), 569-588.

72. *Imbedding punctured lens spaces and connected sums*, Pacific J. Math. **279** (1983), 569-588.
73. *Imbedding 4-manifolds and slicing links*, Proc. Camb. Phil. Soc. **91** (1982), 107-110.

Preprints

1. Simple groups and complements of smooth surfaces in simply connected 4-manifolds (with S. Hughes). <https://arxiv.org/abs/2402.01921>.
2. The conformal Laplacian and positive scalar curvature metrics on manifolds with boundary (with S. Rosenberg and J. Xu). <http://www.arxiv.org/abs/2302.05521>.
3. Families of diffeomorphisms, embeddings, and positive scalar curvature metrics via Seiberg-Witten theory (with Dave Auckly). Manuscript available upon request.
4. Families of diffeomorphisms and embeddings via Donaldson theory (with Dave Auckly). Manuscript available upon request.
5. *The Seiberg-Witten invariants of manifolds with wells of negative curvature*. <http://www.arxiv.org/abs/math.GT/0205234>.

Recent and upcoming invited addresses

Gauge Theory and Topology, Oxford, July 2023
University of Tokyo Topology Seminar, May 2023
Tokyo Institute of Technology Topology Seminar, April 2023
Gauge theory in Kyoto, March 2023
Conference on 4-dimensional topology, Tsinghua University, March 2023
Lecture Series: Gauge theory and 4-manifolds, Kyoto University, March 2023
University of Miami Topology Seminar, February 2023
University of California, Berkeley Topology Seminar, February 2023
University of California, Davis Topology Seminar, January 2023
Frontiers in Geometry and Topology, ICTP Trieste, August 2022
Georgia Topology Seminar, May 2022
Harvard Gauge Theory and Topology Seminar, March 2022
Georgia Tech Topology Seminar, January 2022
Kansas State University Colloquium & Topology Seminar, October 2021.
Georgia Topology Conference, June 2021
Building Bridges Seminar, May 2021
Plenary Speaker, Graduate Student Topology and Geometry Conference, April 2021
[K-OS] Knot online seminar, March 2021
Regensburg low-dimensional geometry and topology seminar, January 2021
AMS Virtual Special Session on Knotted Surfaces and Concordances, October 2020
University of Minneapolis Colloquium, October 2020
Florida International University Geometry Seminar, October 2020
Princeton Topology Seminar, February 2020
CMI workshop on Low-Dimensional Topology, Oxford, January 2020
Unifying 4-Dimensional Knot Theory, Banff, November 2019
AMS Special Session on Floer Homology in Dimensions 3 and 4, Madison, September 2019
AIM Workshop on knot concordance, June 2019
MIT Topology Seminar, May 2019
University of Texas Topology Seminar, April 2019
Northeastern University Analysis and Geometry Seminar, April 2019
Virginia Topology Conference, December 2018
Rutgers University Colloquium, September 2018
University of Regensburg, Conference on Gauge theory and applications, July 2018
Bob Gompf Birthday Conference, UT Austin, July 2018
Joint LA Topology Seminar, UCLA, April 2018
Jim Hoste Retirement Conference, Pitzer College, April 2018
University of Nevada, Reno Topology Seminar, April 2018
Philadelphia Area Contact Topology Seminar (PACT), February 2018
Stanford University, Geometry Seminar, February 2018
University of California, Davis Graduate Topology Seminar, February 2018

PhD students

1991	Hans Boden	Representations of Orbifold Groups and Parabolic Bundles
1994	Su-Ming Wu	A Connected Sum Theorem for Kuranishi Vector Fields on 3-Manifolds
1996	Luc Patry	Points of Structural Transitions of Dirichlet Domains and Applications to Flat 3-Manifolds and Lens Spaces
1998	Benoit Gérard	Singular Connections on Three-Manifolds and Manifolds with Cylindrical Ends
2001	Saso Strle	Genus Bounds for Divisible Two-dimensional Homology Classes in Four-manifolds
2002	The Khoi Vu	A Cut and Paste Method for Computing Seifert Volume
2005	Hee Jung Kim	Modifying Surfaces in 4-Manifolds by Twist-Spinning
2007	Sridhar Rajagopalan	Heegaard Floer homology and symmetries of knots and links in the three sphere
2007	Georgi Gospodinov	Relative invariants of Legendrian knots
2010	Mark Radosevich	Concave spin fillings of contact 3-manifolds
2012	Matt Graham	Studying Embedded Surfaces Using Heegaard-Floer Theory
2013	Alyson Hildum (Burchardt)	The Hausmann-Weinberger 4-manifold invariant of right-angled Artin groups
2015	Tynan Kelly	Twisted Linking Numbers and Casson-Gordon Invariants
2017	Katherine Raoux	τ -invariants for knots in rational homology spheres
2017	Biji Wong	Torsion Invariants of 3-orbifolds, Equivariant Corks, & Heegaard Floer Homology
2020	Langte Ma	Gluings and Surgery for the Casson-Seiberg-Witten Invariant of Integral Homology $S^1 \times S^3$
2020	McKee Krumpak	Twisted h-invariants
2023	Ian Montague	Seiberg-Witten Floer K-Theory and Cyclic Group Actions
2023	Charles Stine	Surfaces and Corks in Knot Traces