

Tomasz S. Mrowka

Professor of Mathematics, MIT

Curriculum Vitae

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Current address

Department of Mathematics, Room 2-440
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Research interests

Partial differential equations; differential topology of three- and four-dimensional manifolds; knot theory; and mathematical aspects of gauge theories.

Academic appointments

- Professor of Mathematics, Massachusetts Institute of Technology, 1996-present.
- Singer Professor of Mathematics, Massachusetts Institute of Technology, 2007-2017.
- Simons Professor of Mathematics, Massachusetts Institute of Technology, 2006-2007.
- Fellow, Radcliffe Institute for Advanced Study, 2012-2013.
- Member, Institute for Advanced Study, 2003-2004 academic year.
- Visiting Professor of Mathematics, Massachusetts Institute of Technology, Fall 1995.
- Clay Visiting Professor of Mathematics, Harvard University, Spring 1995.
- Professor of Mathematics, California Institute of Technology, 1994-1996.
- Associate Professor of Mathematics, California Institute of Technology, 1992-1994.
- Visiting Assistant Professor of Mathematics, California Institute of Technology, 1991-1992.
- Szegő Assistant Professor of Mathematics, Stanford University, 1989-1991.
- Research Fellow, Mathematical Sciences Research Institute, 1988-1989.

Education

- Ph.D. in Mathematics, University of California, Berkeley, 1988. Dissertation: A Local Mayer-Vietoris Principle for Yang-Mills Moduli Spaces, under the direction of Clifford H. Taubes and Robion C. Kirby.
- S.B. in Mathematics, Massachusetts Institute of Technology, 1983.

Honors and awards

- Leroy P. Steele Prize for Seminal Contribution to Research, American Mathematical Society, jointly with Peter B. Kronheimer, 2023.
- Simons Fellowship in Mathematics, 2017.
- Elected to the National Academy of Sciences, 2015.
- Joseph L. Doob Prize, American Mathematical Society, jointly with Peter B. Kronheimer, 2011.
- Guggenheim Fellow, 2010.
- Elected to the American Academy of Arts and Sciences, 2007.
- Oswald Veblen Prize in Geometry, American Mathematical Society, jointly with Peter B. Kronheimer, 2007.
- Participant, Fifth Annual National Academy of Sciences Symposium on the Frontiers of Science, Irvine, California, November 4-6, 1993.
- Sloan Research Fellow, 1993-1995.
- National Young Investigator, 1993-1998.

Publications

Books

2. P. B. Kronheimer and T. S. Mrowka, Monopoles and Three-Manifolds, New Mathematical Monographs 10, Cambridge University Press, 2007, xii+796 pp. DOI: [10.1017/CBO9780511543111](https://doi.org/10.1017/CBO9780511543111).
1. J. W. Morgan, T. S. Mrowka, and D. Ruberman, The L^2 -Moduli Space and a Vanishing Theorem for Donaldson Polynomial Invariants, Monographs in Geometry and Topology II, International Press, 1994, ii+222 pp.

Preprints

1. P. B. Kronheimer and T. S. Mrowka, "SU(3) instanton homology for webs and foams," [arXiv:2505.02755](https://arxiv.org/abs/2505.02755) [math.GT], 2025.

Refereed research papers

36. P. B. Kronheimer and T. S. Mrowka, "Relations in singular instanton homology," *Geom. Topol.* 29 (2025), 1975-2046. DOI: [10.2140/gt.2025.29.1975](https://doi.org/10.2140/gt.2025.29.1975).
35. P. B. Kronheimer and T. S. Mrowka, "Instantons and some concordance invariants of knots," *J. Lond. Math. Soc.* (2) 104 (2021), no. 2, 541-571.
34. P. B. Kronheimer and T. S. Mrowka, "Instantons and Bar-Natan homology," *Compos. Math.* 157 (2021), no. 3, 484-528.
33. P. B. Kronheimer and T. S. Mrowka, "The Dehn twist on a sum of two K3 surfaces," *Math. Res. Lett.* 27 (2020), no. 6, 1767-1783.
32. P. B. Kronheimer and T. S. Mrowka, "A deformation of instanton homology for webs," *Geom. Topol.* 23 (2019), no. 3, 1491-1547.
31. P. B. Kronheimer and T. S. Mrowka, "Tait colorings, and an instanton homology for webs and foams," *J. Eur. Math. Soc.* 21 (2019), no. 1, 55-119.
30. P. B. Kronheimer and T. S. Mrowka, "Knots, three-manifolds and instantons," in *Proceedings of the International Congress of Mathematicians-Rio de Janeiro 2018*, vol. I, World Scientific, 2018, 607-634.
29. P. B. Kronheimer and T. S. Mrowka, "Exact triangles for $SO(3)$ instanton homology of webs," *J. Topol.* 9 (2016), 774-796.
28. T. Mrowka, D. Ruberman, and N. Saveliev, "Index theory of the de Rham complex on manifolds with periodic ends," *Algebr. Geom. Topol.* 14 (2014), no. 6, 3689-3700.
27. P. B. Kronheimer and T. S. Mrowka, "Filtrations on instanton homology," *Quantum Topol.* 5 (2014), no. 1, 61-97.
26. P. B. Kronheimer and T. S. Mrowka, "Gauge theory and Rasmussen's invariant," *J. Topol.* 6 (2013), no. 3, 659-674; see the corrigendum included with arXiv:1110.1297.
25. P. B. Kronheimer and T. S. Mrowka, "Knot homology groups from instantons," *J. Topol.* 4 (2011), no. 4, 835-918.
24. P. B. Kronheimer and T. S. Mrowka, "Khovanov homology is an unknot-detector," *Publ. Math. Inst. Hautes Études Sci.* 113 (2011), 97-208.
23. T. S. Mrowka, D. Ruberman, and N. Saveliev, "Seiberg-Witten equations, end-periodic Dirac operators, and a lift of Rohlin's invariant," *J. Differential Geom.* 88 (2011), no. 2, 333-377.
22. T. S. Mrowka and K. Wehrheim, " L^2 -topology and Lagrangians in the space of connections over a Riemann surface," *Geom. Funct. Anal.* 20 (2010), no. 5, 1278-1305.
21. P. B. Kronheimer and T. S. Mrowka, "Knots, sutures, and excision," *J. Differential Geom.* 84 (2010), no. 2, 301-364.
20. P. B. Kronheimer and T. S. Mrowka, "Instanton Floer homology and the Alexander polynomial," *Algebr. Geom. Topol.* 10 (2010), no. 3, 1715-1738.
19. P. B. Kronheimer, T. S. Mrowka, P. S. Ozsváth, and Z. Szabó, "Monopoles and lens space surgeries," *Ann. of Math.* (2) 165 (2007), no. 2, 457-546.
18. T. Mrowka and Y. Rollin, "Legendrian knots and monopoles," *Algebr. Geom. Topol.* 6 (2006), 1-69.
17. P. B. Kronheimer and T. S. Mrowka, "Witten's conjecture and Property P," *Geom. Topol.* 8 (2004), 295-310.
16. P. M. N. Feehan, P. B. Kronheimer, T. G. Leness, and T. S. Mrowka, "PU(2) monopoles and a conjecture of Mariño, Moore, and Peradze," *Math. Res. Lett.* 6 (1999), no. 2, 169-182.
15. T. Mrowka, P. Ozsváth, and B. Yu, "Seiberg-Witten monopoles on Seifert fibered spaces," *Comm. Anal. Geom.* 5 (1997), no. 4, 685-791.
14. J. W. Morgan, T. S. Mrowka, and Z. Szabó, "Product formulas along T^3 for Seiberg-Witten invariants," *Math. Res. Lett.* 4 (1997), no. 6, 915-929.
13. P. B. Kronheimer and T. S. Mrowka, "Scalar curvature and the Thurston norm," *Math. Res. Lett.* 4 (1997), no. 6, 931-937.
12. P. B. Kronheimer and T. S. Mrowka, "Monopoles and contact structures," *Invent. Math.* 130 (1997), no. 2, 209-255.
11. J. W. Morgan and T. S. Mrowka, "The smooth classification of elliptic surfaces," in *Geometry, Topology, & Physics, Conf. Proc. Lecture Notes Geom. Topology IV*, International Press, 1995, 246-292.
10. P. B. Kronheimer and T. S. Mrowka, "Gauge theory for embedded surfaces II," *Topology* 34 (1995), no. 1, 37-97.
9. P. B. Kronheimer and T. S. Mrowka, "Embedded surfaces and the structure of Donaldson's polynomial invariants," *J. Differential Geom.* 41 (1995), no. 3, 573-734.
8. S. Akbulut, T. Mrowka, and Y. Ruan, "Torsion classes and a universal constraint on Donaldson invariants for odd manifolds," *Trans. Amer. Math. Soc.* 347 (1995), no. 1, 63-76.
7. P. B. Kronheimer and T. S. Mrowka, "The genus of embedded surfaces in the projective plane," *Math. Res. Lett.* 1 (1994), no. 6, 797-808.
6. P. B. Kronheimer and T. S. Mrowka, "Recurrence relations and asymptotics for four-manifold invariants," *Bull. Amer. Math. Soc. (N.S.)* 30 (1994), no. 2, 215-221.
5. J. W. Morgan and T. S. Mrowka, "On the diffeomorphism classification of regular elliptic surfaces," *Internat. Math. Res. Notices* (1993), no. 6, 183-184.
4. P. B. Kronheimer and T. S. Mrowka, "Gauge theory for embedded surfaces I," *Topology* 32 (1993), no. 4, 773-826.
3. R. E. Gompf and T. S. Mrowka, "Irreducible 4-manifolds need not be complex," *Ann. of Math.* (2) 138 (1993), no. 1, 61-111.

2. J. W. Morgan and T. S. Mrowka, "A note on Donaldson's polynomial invariants," *Internat. Math. Res. Notices* (1992), no. 10, 223-230.

1. T. Mrowka, "A short proof of the Birkhoff-Smale theorem," *Proc. Amer. Math. Soc.* 93 (1985), no. 2, 377-378.

Book chapters

1. T. S. Mrowka and D. Wang, "Gauge theory and a few applications to knot theory," in *Quantum Field Theory and Manifold Invariants*, IAS/Park City Mathematics Series 28, American Mathematical Society, 2021, 253-345.

Ph.D. students

Name	Institution	Year
Yongbin Ruan	University of California, Berkeley	1991
Christopher Herald	University of California, Berkeley	1992
Graham Taylor	University of California, Berkeley	1994
Baozhen Yu	University of California, Berkeley	1994
Qing Yang	California Institute of Technology	1999
Carmen Young	Massachusetts Institute of Technology	2000
Anda Degeratu	Massachusetts Institute of Technology	2001
Edward Goldstein	Massachusetts Institute of Technology	2001
Yue Lei	Massachusetts Institute of Technology	2001
Lenhard Ng	Massachusetts Institute of Technology	2001
Aleksey Zinger	Massachusetts Institute of Technology	2002
Eun Soo Lee	Massachusetts Institute of Technology	2003
Benoit Charbonneau	Massachusetts Institute of Technology	2004
Lawrence Guth	Massachusetts Institute of Technology	2005
Fangyun Yang	Massachusetts Institute of Technology	2007
Maksim Lipianskiy	Massachusetts Institute of Technology	2008
William Lopes	Massachusetts Institute of Technology	2010
Bernard Mares	Massachusetts Institute of Technology	2010
Timothy Nguyen	Massachusetts Institute of Technology	2011
Steven Sivek	Massachusetts Institute of Technology	2011
Tirasan Khandawit	Massachusetts Institute of Technology	2013
Lucas Culler	Massachusetts Institute of Technology	2014
Francesco Lin	Massachusetts Institute of Technology	2016
Yakov Berchenko-Kogan	Massachusetts Institute of Technology	2016
Sherry Gong	Massachusetts Institute of Technology	2018
Piotr Suwara	Massachusetts Institute of Technology	2020
Zhenkun Li	Massachusetts Institute of Technology	2020
Jesse Freeman	Massachusetts Institute of Technology	2021
Donghao Wang	Massachusetts Institute of Technology	2021
Greg Parker	Massachusetts Institute of Technology	2022
Deepraj Bhat	Massachusetts Institute of Technology	2024
Mary Stelow	Massachusetts Institute of Technology	2026

Postdoctoral scholars mentored

Name	Institution	Year
Peter Ozsváth	California Institute of Technology	1992-1994
Matilde Marcolli	Massachusetts Institute of Technology	1997-2000
Matthew Hedden	Massachusetts Institute of Technology	2006-2008
Yi Ni	Massachusetts Institute of Technology	2007-2009
Jonathan Bloom	Massachusetts Institute of Technology	2011-2014
Bohua Zhan	Massachusetts Institute of Technology	2014-2017
Linh Truong	Massachusetts Institute of Technology	2016-2017
Jianfeng Lin	Massachusetts Institute of Technology	2016-2019
Yu Pan	Massachusetts Institute of Technology	2017-2019
Matthew Stoffregen	Massachusetts Institute of Technology	2017-2019
Maggie Miller	Massachusetts Institute of Technology	2019-2020
Irving Dai	Massachusetts Institute of Technology	2019-2020
Lisa Piccirillo	Massachusetts Institute of Technology	2019-2020
Jonathan Zung	Massachusetts Institute of Technology	2022-2025
Joshua Wang	Massachusetts Institute of Technology	2023-2024

Selected distinguished and invited lectures

Plenary and named lectures

- Plenary speaker, jointly with Peter B. Kronheimer, International Congress of Mathematicians, Rio de Janeiro, August 2018.
- The Structure of Donaldson's Polynomial Invariants, International Congress of Mathematicians, 45-minute invited address in Geometry, Zürich, August 3-11, 1994.
- Instanton Homology for Links and Webs in 3-Manifolds, Minerva Distinguished Visitor Mini-Course, Princeton University, March 5 and 19; April 2, 9, 16, and 23; and May 7, 2025.
- Forty Years of Four-Manifolds, Myhill Lectures, University at Buffalo, April 23-25, 2024.
- Applications of Gauge Theory to the Topology of Three-Manifolds and Maybe Combinatorics, Clifford Lectures, Tulane University, January 23-26, 2019.
- Applications of Gauge Theory to 3-Dimensional Topology and Maybe to Combinatorics, Roever Lecture, Washington University in St. Louis, March 6, 2018.
- How to Detect Unknottedness Using Instantons and Khovanov Homology, MSRI Evans Lecture Series, University of California, Berkeley, February 22, 2010.
- Knots, 3-Manifolds and Gauge Theories, Kuwait Foundation Lectures, University of Cambridge, March 3, 2009.
- Floer's Instanton Homology and Representations of Three-Manifold Fundamental Groups and Witten's Conjecture and Property P, Joseph Fels Ritt Lectures, Columbia University, April 15-16, 2004.
- Gauge Theory and Low-Dimensional Topology: Past, Present and Future I-III, Marston Morse Lectures, Institute for Advanced Study, Princeton, March 28-29 and April 1, 1999.

Lecture series and courses

- Floer Homology of Three-Manifolds and Applications to Low-Dimensional Topology, weekly lectures, Institute for Theoretical Studies, ETH Zürich, September 30-December 16, 2024.
- Gauge Theory on Foams I-III, jointly with Peter Kronheimer, Massachusetts Institute of Technology, May 17-19, 2023.
- Floer Homology, Park City Mathematics Institute Graduate Summer School, July 16-19, 2019.
- Lectures on Gauge Theory for Webs and Foams, four lectures, Universität Regensburg, July 19-20, 2018.
- Instantons, Knots and Khovanov, one-week lecture course, Centre for Quantum Geometry of Moduli Spaces, Aarhus University, August 1-5, 2011.
- Lectures on Seiberg-Witten Floer Homology, ETH Zürich, July 2008.

Selected recent conference lectures

- Instanton Knot Homology Groups for Webs, Swiss Knots Conference, Université de Genève, June 4, 2025.
- A Variant of Instanton Floer Homology, Simons Collaboration on New Structures in Low-Dimensional Topology, Simons Foundation, New York, March 28, 2024; Workshop on Low-Dimensional Topology and Gauge Theory, Miami Beach, April 11, 2024.
- 30 Years of Working with Peter, Gauge Theory and Topology: A Celebration of Peter Kronheimer's 60th Birthday, Clay Mathematics Institute, Oxford, July 27, 2023.
- Complex Curves Coming from Instanton Floer Homology of Product Orbifolds, AMS-EMS-SMF Joint Meeting, Université Grenoble Alpes, July 18, 2022.

Professional service

Current editorial leadership

- Journal of Symplectic Geometry.
- Advances in Mathematics.

Previous editorial service

- Mathematical Research Letters, 1994-2026.
- Geometry & Topology, 1997-2026.
- Publications Mathématiques de l'IHÉS, 2011-2015.
- Journal of the American Mathematical Society: associate editor, 2006-2010; managing editor, 2010-2016.

MIT service

- MIT Faculty Complaint Review Panel, 2023-present.
- Head, Department of Mathematics, Massachusetts Institute of Technology, November 2014-June 2017.
- Interim Head, Department of Mathematics, Massachusetts Institute of Technology, June-November 2014.
- Chair, Pure Mathematics Committee, Massachusetts Institute of Technology, 2004-2009 and 2011-2014 academic years.
- Chair, Mathematics Graduate Student Committee, Massachusetts Institute of Technology, 1999-2002 academic years.
- MIT Committee on Discipline, 2001-2003.
- MIT Committee on Graduate School Programs, 1999-2002.

Service to the mathematical community

- Selection Committee, Sloan Research Fellowships in Mathematics, 2011-2016.
- AMS Steele Prize Selection Committee, 2012-2014; chair, 2014.
- Visiting Committee, School of Mathematics, Institute for Advanced Study, Princeton, March 14-16, 2008.
- Co-organizer, with Peter Ozsváth, Park City Mathematics Institute Summer School in Low-Dimensional Topology, 2006.
- Japanese-American Frontiers of Science Planning Group, 1998-2000, sponsored by the National Academy of Sciences and the Japan Science and Technology Corporation.
- National Science Foundation Committee of Visitors, Division of Mathematical Sciences, 1995, 1998, and 2024.