

BOYU ZHANG

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ACADEMIC APPOINTMENT

2022- : Assistant Professor (tenure-track), University of Maryland at College Park, Maryland
2021-2022: Assistant Professor, Princeton University, New Jersey
2018-2021: Instructor of Mathematics, Princeton University, New Jersey

EDUCATION

2013-2018: Harvard University, Massachusetts
Ph.D. in Mathematics
Advisor: Clifford Taubes
Thesis: Several compactness results in gauge theory and low dimensional topology
2009-2013: Peking University, Beijing, China.
B.S. in Mathematics

RESEARCH INTEREST

I am interested in gauge theory, Floer homology, and their interactions with geometric structures on 3 and 4-dimensional manifolds such as knots and links, foliations, contact structures, and symplectic structures.

PUBLICATIONS AND PREPRINTS

1. $\mathbb{Z}/2$ harmonic 1-forms, \mathbb{R} -trees, and the Morgan-Shalen compactification (with Siqi He and Richard Wentworth), arXiv 2409.04956.
2. Ring structures in singular instanton homology (with Yi Xie), arXiv 2307.08845.
3. A deformation of Asaeda-Przytycki-Sikora homology (with Zhenkun Li and Yi Xie), arXiv 2302.11109. Accepted by *Algebr. Geom. Topol.*
4. Instanton homology and knot detection on thickened surfaces (with Zhenkun Li and Yi Xie), *Selecta Math.*, 29, Article number: 84 (2023)
5. A note on the existence of U-cyclic elements in periodic Floer homology (with Dan Cristofaro-Gardiner, Daniel Pomerleano, Rohil Prasad), arxiv 2110.13844, accepted by *Proc. Amer. Math. Soc.*
6. The smooth closing lemma for area-preserving surface diffeomorphisms (with Dan Cristofaro-Gardiner and Rohil Prasad), arxiv 2110.02925
7. On Floer minimal knots in sutured manifolds (with Zhenkun Li and Yi Xie), *Trans. Amer. Math. Soc. Ser. B* 9 (2022), 499-516
8. On meridian-traceless $SU(2)$ -representations of link groups (with Yi Xie), *Adv. Math.* 418 (2023).

9. Equivariant Cerf theory and perturbative $SU(n)$ Casson invariants (with Shaoyun Bai), arXiv 2009.01118.
10. Instantons and Khovanov skein homology on $I \times T^2$ (with Yi Xie), arXiv 2005.12863, accepted by Quantum Topology.
11. Two detection results of Khovanov homology on links (with Zhenkun Li and Yi Xie), Trans. Amer. Math. Soc. 374 (2021), 6649-6664.
12. On links with Khovanov homology of small ranks (with Yi Xie), Math. Res. Lett. Volume 29 (2022), 1261 – 1277.
13. Classification of links with Khovanov homology of minimal rank (with Yi Xie), arXiv 1909.10032, J. Eur. Math. Soc. (2023)
14. Instanton Floer homology for sutured manifolds with tangles (with Yi Xie), arXiv 1907.00547, accepted by J. Differential Geom.
15. On the compactness problem for a family of generalized Seiberg-Witten equations in dimension three (with Thomas Walpuski), Duke Math. J. 170(17): 3891-3934.
16. Rectifiability and Minkowski bounds for the zero loci of $\mathbb{Z}/2$ harmonic spinors in dimension 4, Commun. Anal. Geom. Volume 30 (2022) Number 7: 1633 – 1681
17. Modulo 2 counting of Klein-bottle leaves in smooth taut foliations, Algebr. Geom. Topol., 2018 Aug 22; 18(5): 2701-2727.
18. Monopoles and foliations without holonomy-invariant transverse measure, J. Symplectic Geom., Volume 20, Number 1, 191–258, 2022.

INTERDISCIPLINARY COLLABORATIONS

1. Yue Wang, Boyu Zhang, Jérémie Kropp, Nadya Morozova: *Inference on tissue transplantation experiments*, Journal of Theoretical Biology, Volume 520.
2. Hui Zhao, Kehua Su, Chenchen Li, Boyu Zhang, Lei Yang, Na Lei, Xiaoling Wang, Steven J. Gortler, Xianfeng Gu: *Mesh Parametrization Driven by Unit Normal Flow*, Computer Graphics Forum, Volume 39, Issue 1.

TEACHING

MATH 140: Calculus I (Fall 2024)
 MATH 734: Algebraic Topology (Spring 2024)
 MATH 410: Advanced Calculus (Spring 2023)
 MATH 432: Introduction to Topology (Fall 2022 and Fall 2023)
 MAT 204: Advanced Linear Algebra with Applications (Spring 2022, Princeton)
 MAT 215: Single Variable Analysis with an Introduction to Proofs (Fall 2021, Princeton)
 MSRI graduate summer school: Gauge Theory in Geometry and Topology (Summer 2021)
 MAT 92: Topics in Gauge Theory (Spring 2021, Princeton)

MAT 175: Mathematics for Economics and Life Sciences (Fall 2020 and Spring 2021, Princeton)
MAT 567: Topics in Low Dimensional Topology (Spring 2020, Princeton)
MAT 92: Morse Theory (Fall 2019, Princeton)
MAT 175: Mathematics for Economics and Life Sciences (Fall 2019, Princeton)
MAT 104: Calculus II (Fall 2018, Spring 2019, Princeton)
Math 1b: Calculus, Series, and Differential Equations. (Spring 2017, Harvard)
Undergraduate Tutorial: Morse Theory (Spring 2016, Harvard)
Qualifying Exam Tutorial (Summer 2015, Harvard)
Summer Tutorial: Knots and Links (Summer 2015, Harvard)
Math 1b: Calculus, Series, and Differential Equations. (Spring 2015, Harvard)
Qualifying Exam Tutorial (Summer 2014, Harvard)

SELECTED SERVICES AND OUTREACH

Co-organizer of the Brin Maryland Mathematics Camp
Member of the organizational committee for the University of Maryland High School Math Competition
Co-organizer of the DC Jail College Bridge Math program by Petey-Greene in 2023
Co-organizer of the Geometry and Topology seminar at the University of Maryland at College Park
Co-organizer of the Brin Mathematics Research Center workshop on *Low-dimensional topology and homeomorphism groups* in 2022
Co-organizer of the MSRI graduate summer school on *Gauge Theory in Geometry and Topology* in 2021
Co-organizer of Princeton Topology Seminar from 2018 to 2022

AWARDS AND FELLOWSHIPS

1. 2024-2027: NSF standard grant DMS-2405271
2. 2023-2028: Simons Foundation Travel Support for Mathematicians
3. 2017: Harvard University, Graduate School of Arts and Sciences, Merit Fellowship
4. 2013: Peking University, School of Mathematical Sciences, Xiao-Song Lin award
5. 2011,2012: S-T. Yau College Students Mathematics Contests, 4 gold medals and 2 silver medals

LANGUAGES

Native speaker of Chinese, fluent in English.
Passed the French and German reading exams at Harvard.

RESEARCH TALKS

May 2024 *Gauge Theory, Low-Dimensional Topology, and Geometric Analysis Conference*,
Rutgers University

Mar 2024 *Conference on Floer homology, low-dimensional topology, and algebra*,
 Princeton University
 Feb 2024 *Geometry and Topology seminar*, University of Washington
 Dec 2023 *Knots in Washington conference*, George Washington University
 Oct and Dec 2023 *Gauge theory seminar*, Rutgers University at New Brunswick
 Oct 2023 *Geometry seminar*, University of Virginia
 Sep 2023 *Geometry and Topology seminar*, University of Washington at St. Louis
 Sep 2023 *AMS Sectional meeting*, University of Buffalo
 Aug 2023 *Hua Luogeng Youth Forum*, Chinese Academy of Sciences
 Jul 2023 Plenary talk at *Graduate Student Topology and Geometry Conference*, Harvard University
 Apr 2023 *Conference on Gauge Theory and Low Dimensional Topology*, University of Miami
 Apr 2023 *AMS sectional meeting*
 Nov 2022 *Gauge Theory and Topology Seminar*, Harvard University
 Sep 2022 *Symplectic Geometry Seminar*, Stony Brook University and Simons Center
 Jun 2022 *Workshop on Geometric Analysis and Calibrated Geometries*, ETH Zurich
 Mar 2022 *Colloquium*, Rutgers University at Newark
 Feb 2022 *Southeast China Topology Workshop*
 Jan 2022 *Interdisciplinary Science Seminar*, Harvard University
 Nov 2021 *Geometry Seminar*, University of Kansas
 Oct 2021 *Geometry Seminar*, University of Virginia
 Jun 2021 *Knot Theory Seminar*, University of Warsaw
 May 2021 *Geometric Analysis Conference*, Rutgers University
 May 2021 *Topology Seminar*, UCSD
 Mar 2021 *AMS sectional meeting*
 Feb 2021 *Geometry and Topology Seminar*, University of Waterloo
 Nov 2020 *Geometric analysis seminar*, Rutgers University
 Nov 2020 *Geometry, Topology and Dynamics seminar*, Boston College
 Nov 2020 *Topology Seminar*, Stanford University
 Oct 2020 *Geometry and Topology Seminar*, Caltech
 Oct 2020 *AMS sectional meeting*
 Sep 2020 *Trends in low-dimensional topology seminar*
 Jun 2020 *Regensburg low-dimensional geometry and topology seminar*
 Feb 2020 *Topology Seminar*, Princeton University
 Feb 2020 *Symplectic Topology Seminar*, IAS
 Jan 2020 *Symplectic Geometry, Gauge Theory, and Categorification Seminar*, Columbia University
 Jan 2020 *Topology seminar*, UCSD
 Dec 2019 *Topology seminar*, Chinese Academy of Sciences
 Dec 2019 *Workshop on gauge theory and Floer homology*, Peking University
 Dec 2019 *SIAM Conference on Analysis of Partial Differential Equations*, La Quinta, California
 Dec 2019 *AMS sectional meeting*, University of Florida

- Oct 2019 *Geometry and Topology Seminar*, Michigan State University
 - Oct 2019 *Topology seminar*, MIT
 - Jul 2019 Short talk at the *IAS/IPAM summer program*, Park City
 - May 2019 *Georgia Topology Conference*, University of Georgia
 - Jan 2019 Plenary talk at the *14th East Asian Conference on Geometric Topology*, Peking University
 - Nov 2018 *Topology Seminar*, Rutgers University
 - Oct 2018 *Geometry and Topology Seminar*, Stony Brook University
 - Mar 2018 *Analysis and PDE Seminar*, Stanford University
 - Feb 2018 *Topology Seminar*, Princeton University
 - Feb 2018 *Geometry and Topology Seminar* Michigan State University
 - Dec 2017 *Embedding questions in symplectic topology: Dusa McDuff*, workshop at Tsinghua Sanya
- International Mathematics Forum
- Apr 2017 *Floer homologies and topology of 4-manifolds*, University of Massachusetts, Amherst
 - Jan 2017 *Geometry and Topology Seminar*, Peking University
 - Dec 2016 *Topology Seminar*, Princeton University
 - Oct 2016 *Geometry and Topology Seminar*, California Institute of Technology
 - Sep 2016 *Geometry Seminar*, University of Virginia
 - Sep 2016 *Geometry and Topology Seminar*, Massachusetts Institute of Technology
 - Sep 2016 *S-T. Yau's Student seminar*, Harvard University