

XUWEN ZHU

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Employment:

2020 – Assistant Professor, Northeastern University
2020 Spring Lecturer, MIT
2019 Fall Uhlenbeck Postdoctoral Fellow, MSRI
2018 – 2019 Morrey Visiting Assistant Professor, UC Berkeley
2015 – 2018 Szegő Assistant Professor, Stanford University

Education:

2010 – 2015 Ph.D. Mathematics, Massachusetts Institute of Technology.
Thesis advisor: Richard Melrose
2006 – 2010 B.S. Mathematics, Peking University, China.

Papers:

1. *Noncollapsing degeneration of gravitational instantons.*
Joint with Yu-Shen Lin and Sidharth Soundararajan. In preparation.
2. *Tian–Yau metrics: Fredholm theory, Hodge cohomology and moduli spaces.*
Joint with Rafe Mazzeo. In preparation.
3. *A gluing construction of D_k ALF gravitational instantons and existence of non-holomorphic minimal spheres.*
[arXiv:2407.20149](https://arxiv.org/abs/2407.20149)
4. *Closed-Form Adaptive Tracking Control of Heat Equations Aided by Fourier Regularization and Bi-orthogonal Series.*
Joint with Tong Ma. Submitted, 2024.
5. *Degenerating hyperbolic surfaces and spectral gaps for large genus.*
Joint with Yunhui Wu and Haohao Zhang. [arXiv:2201.03056](https://arxiv.org/abs/2201.03056)
Analysis & PDE, Vol. 17 (2024), No. 4, 1377–1395
6. *Spherical conical metrics and harmonic maps to spheres.*
Joint with Mikhail Karphukhin. [arXiv:2104.10304](https://arxiv.org/abs/2104.10304)
Transactions of the AMS, Volume 375, Number 5, May 2022, Pages 3325–3350.
7. *Fundamental gaps of spherical triangles.* Joint with Shoo Seto and Guofang Wei.
[arXiv:2009.00229](https://arxiv.org/abs/2009.00229)
Annals of Global Analysis and Geometry 61, pages 1–19 (2022).
8. *Spectral properties of reducible conical metrics.* Joint with Bin Xu.
[arXiv:1909.00546](https://arxiv.org/abs/1909.00546)
Illinois Journal of Mathematics, Vol. 65, No. 2 (2021), 313–337.
9. *Conical metrics on Riemann surfaces, II: spherical metrics.*
Joint with Rafe Mazzeo. [arXiv:1906.09720](https://arxiv.org/abs/1906.09720)
International Mathematics Research Notices, Volume 2022, Issue 12, June 2022, Pages 9044–9113

10. *Rigidity of a family of spherical conical metrics.* [arXiv:1902.02024](#)
New York Journal of Mathematics 26 (2020) 272–284.
11. *Spherical conic metrics and realizability of branched covers.* [arXiv:1805.03312](#)
Proceedings of the AMS, Volume 147, Number 4, April 2019, Pages 1805–1815.
12. *Conical metrics on Riemann surfaces, I: the compactified configuration space and regularity.* Joint with Rafe Mazzeo. [arXiv:1710.09781](#)
Geometry & Topology 24-1 (2020), 309–372.
13. *Boundary behaviour of Weil-Petersson and fiber metrics for Riemann moduli spaces.* Joint with Richard Melrose. [arXiv:1606.01158](#)
International Mathematics Research Notices, Volume 2019, Issue 16, Pages 5012–5065.
14. *Eleven dimensional supergravity equations on edge manifolds.* [arXiv:1507.02322](#)
Annales Henri Poincaré, Volume 19, Issue 8 (2018), 2347–2400.
15. *Eigenvalue resolution of self-adjoint matrices.* [arXiv:1504.07581](#)
Pacific Journal of Mathematics, Vol. 288 (2017), No. 1, 241–255.
16. *Resolution of the canonical fiber metrics for a Lefschetz fibration.* Joint with Richard Melrose. [arXiv:1501.04124](#)
Journal of Differential Geometry, Volume 108, Number 2 (2018), 295–317.
17. *Numerical Investigation of the Heat Partition Factor During Bolt Tightening.* Joint with Laila Guessous and Gary C. Barber.
Tribology Transactions, Volume 54, Issue 1, 2010

Honors and Awards:

- 2024 – 2025 TIER 1 Grant, NEU
- 2023 – 2026 NSF Geometric Analysis DMS-2305363
“Microlocal Analysis and Singularities”
- 2022 – 2023 College of Science Equity, Diversity, Inclusion, and Justice Faculty Award, NEU
- 2022 College of Science Excellence in Research Award, NEU
- 2019 – 2023 NSF Geometric Analysis DMS-1905398 (DMS-2041823 after transfer)
“Moduli Spaces and Geometric Microlocal Analysis”
- 2019 AWM–NSF Travel Grant
- 2017 – 2019 AMS–Simons Travel Grant
- 2017 AWM–NSF Travel Grant
- 2014 – 2015 Graduate Student Appreciation Fellowship for excellent teaching, MIT
- 2010 – 2011 Presidential Fellowship, MIT

Talks:

- 2025 Jun Conference in Geometric Analysis, Pisa, Italy (upcoming)
- 2024 Nov Geometry and analysis of special structures on manifolds, SLMath (upcoming)
- 2024 July International Congress of Basic Science, plenary speaker, Beijing
- 2024 July Analysis and PDE Seminar, Chinese Academy of Science
- 2024 May “From Microlocal to Global Analysis”, MIT
- 2024 Apr Geometric Analysis Seminar, Ghent University, Belgium (online)

- 2024 Apr Special session "Recent Developments in Geometric Analysis", AMS Spring Eastern Sectional Meeting, Howard University
- 2024 Mar Analysis/PDE Seminar, MIT
- 2024 Jan "Celebrating singularities: conference in honor of Richard Melrose", New College of Florida
- 2023 Dec CMSA colloquium, Harvard
- 2023 Nov NEAT MAPS mini conference in topology and quantum field theory, Boston University
- 2023 Nov New England Dynamics Seminar, Boston University
- 2023 Mar Analysis Seminar, Yale University
- 2023 Feb Analysis and Geometry Seminar, Northeastern University
- 2022 Nov "Geometrical Inverse Problems" Workshop, ESI (online)
- 2022 Oct Math Club Faculty Talk, Northeastern University (online)
- 2022 Aug "Geometry and physics of ALX metrics in gauge theory" Workshop, AIM (online)
- 2022 June "Spherical surfaces and related topics", Cortona, Italy (online)
- 2022 June International Conference on PDEs and Geometric Analysis, SJTU (online)
- 2022 Mar March Speaker Series, AWM Northeastern (online)
- 2022 Jan Webinar on Analysis & PDE (online)
- 2022 Jan Analysis & PDE Seminar, UNC (online)
- 2021 Oct Geometry and Physics Seminar, Boston University
- 2021 Sep Topology and Geometry Seminar, UQAM (online)
- 2021 Sep Topology Seminar, Northeastern University
- 2021 June "What is..." Seminar, Northeastern University (online)
- 2021 June "Analysis, Geometry and Topology of singular PDE", Oberwolfach (online)
- 2021 May Workshop "Analysis on Singular Spaces", BIRS Oaxaca (online)
- 2021 May Geometric Analysis Conference, Rutgers University (online)
- 2021 Mar Differential Geometry Seminar, University of Iowa (online)
- 2020 Dec Differential Geometry Seminar, SCMS (online)
- 2020 Dec 2020 Winter CMS Meeting Section "Geometric and Computational Spectral Theory" (online)
- 2020 Nov Workshop "Geometry and analysis on singular spaces", USTC (online)
- 2020 Sep Analysis-Geometry Seminar, Northeastern University (online)
- 2020 Jun "Spectral Geometry in the Clouds" (online)
- 2020 Feb PDE/Analysis Seminar, MIT
- 2020 Jan Frontier of Analysis and Geometry of Teichmuller Spaces, TSIMF, China
- 2019 Dec Geometry-Topology Seminar, University of Maryland
- 2019 Dec Special Seminar, Brandeis University
- 2019 Dec Special Seminar, Northeastern University
- 2019 Nov Mathematical Colloquium, UC San Diego
- 2019 Nov Iterated structures on manifolds seminar, MSRI
- 2019 Oct "Recent Developments in Microlocal Analysis", MSRI
- 2019 Sep Microlocal Analysis Regular Seminar, MSRI
- 2019 Aug "Connections for Women: Microlocal Analysis", MSRI

- 2019 Aug “Connections for Women: Holomorphic Differentials in Mathematics and Physics”, MSRI
- 2019 July Differentialgeometrie im Grossen, Oberwolfach, Germany
- 2019 June Geometry Seminar, Tsinghua University, China
- 2019 June Microlocal Analysis and Applications, SCMS, China
- 2019 May Microlocal Methods in Analysis and Geometry, CIRM, France
- 2019 Apr Harmonic Analysis and Differential Equations Student Seminar, UC Berkeley
- 2019 Apr 34th Geometry Festival, University of Maryland
- 2019 Apr Topology Seminar, UC Berkeley
- 2019 Mar Graduate Student Conference in Geometry and Topology, UIUC
- 2019 Mar Department Colloquium, UIUC
- 2018 Oct Riverside Mathematics Workshop for Excellence and Diversity, UC Riverside
- 2018 May Informal Geometry & Topology Seminar, Stanford University
- 2018 Mar Bay Area Microlocal Analysis Seminar, UC Berkeley
- 2017 Dec Differential Geometry Seminar, UC Santa Barbara
- 2017 Oct Informal Complex Analysis & PDE Seminar, Columbia University
- 2017 Oct Differential Geometry & Geometric Analysis Seminar, Princeton University
- 2017 Oct Geometry/Topology Seminar, Rutgers University
- 2017 Sep PDE/Analysis Seminar, MIT
- 2017 Aug Workshop “The Analysis of Gauge-Theoretic Moduli Spaces”, BIRS, Canada
- 2017 Aug SURIM, Stanford University
- 2017 July Third Symposium on Spectral and Scattering Theory, Florianópolis, Brazil
- 2017 June Workshop “Analysis and Topology in Interaction”, Cortona, Italy
- 2017 June Workshop “Sen Conjecture and Beyond”, UCL, UK
- 2017 June Geometric Analysis Seminar, Peking University, China
- 2017 June Geometry and Physics Seminar, Tsinghua University, China
- 2017 June Geometric Analysis Seminar, Shanghai Jiaotong University, China
- 2017 May Differential Geometry/PDE Seminar, University of Washington
- 2017 May May Midwestern Microlocal Meeting, Purdue University
- 2017 May Geometry and Analysis Seminar, UC Santa Cruz
- 2017 Apr PDE/Analysis Seminar, MIT
- 2017 Mar PDE/Analysis Seminar, ANU, Australia
- 2017 Feb Moduli Space Learning Seminar, Stanford University
- 2016 Dec Workshop on “Geometric and Spectral Methods in Partial Differential Equations”, CMO, Mexico
- 2016 Jul Analysis Seminar, Shanghai Jiaotong University, China
- 2016 May Paris/Berkeley/Bonn/Zurich Analysis Seminar, UC Berkeley
- 2015 Dec Geometry and Analysis Seminar, UC Santa Cruz
- 2015 Nov Departmental Colloquium, HKUST, Hong Kong
- 2015 Oct Analysis & PDE Seminar, Stanford University
- 2015 Aug Workshop on “Semi-classical Analysis: Spectral Theory and Resonances”, Erwin Schrödinger Institute, Austria
- 2015 Jul Workshop on Metric and Analytic Aspects of Moduli Spaces, Isaac Newton Institute, UK

- 2015 Apr Student Harmonic Analysis and Differential Equations Seminar, UC Berkeley
- 2015 Apr Bay Area Microlocal Analysis Seminar, Stanford University
- 2015 Feb Mathematical Physics and Harmonic Analysis Seminar, Texas A&M University
- 2015 Jan Mini-workshop on Semiclassical and Microlocal Analysis, USTC, China
- 2014 Nov Geometric Analysis Reading Seminar, UCL, UK
- 2014 Nov Geometric Scattering Theory and Applications Workshop, BIRS, Canada
- 2014 Nov Students Analysis Seminar, MIT
- 2014 Oct Analysis and Geometry Seminar, Northeastern University
- 2014 Oct Scattering and Spectral Theory Seminar, Purdue University
- 2014 Oct PDE/Analysis Seminar, MIT
- 2014 Oct Student Differential Geometry Seminar, Harvard University
- 2013 Mar Pure Math Graduate Student Seminar, MIT

Mini-courses:

- 2024 Jun MSRI Graduate Summer School Minicourse on geometric microlocal analysis, 8 lectures
- 2019 Sep MSRI Introductory Workshop: Microlocal Analysis
- 2016 Jul Analysis Minicourse, YMSC, Tsinghua University, China

Conference and Program Organization:

- 2024 Fall Co-organizer, Program “Special Geometric Structures and Analysis”, SLMath (upcoming)
- 2024 Aug Lead organizer, Connections Workshop: New Frontiers in Curvature & Special Geometric Structures and Analysis, SLMath (upcoming)
- 2024 May Co-organizer, Workshop “Moduli spaces and Singularities”, CRM, Montreal

Other Conferences Attended:

- 2023 Jul “Spectral Theory and Mathematical Relativity”, ESI, Austria
- 2022 Aug “Analytic and Geometric Aspects of Spectral Theory”, BIRS, Oaxaca (online)
- 2021 Feb “Recent Advances in Global Analysis” in Honor of Gerardo Mendoza (online)
- 2020 Oct “Special holonomy and branes” Workshop, AIM (online)
- 2019 Nov “Holomorphic Differentials in Mathematics and Physics” Workshop, MSRI
- 2019 Aug MSRI Introductory Workshop: Holomorphic Differentials in Mathematics and Physics
- 2017 July Analytical aspects of hyperbolic flows, Nantes, France
- 2016 June “Analysis, Geometry and Topology of Stratified Spaces” Workshop, CIRM, France
- 2015 May May Midwest Microlocal Meeting, Northwestern University
- 2012 Sep “Weyl Law at 100” Workshop, Fields Institute, Canada
- 2012 Jul Workshop on Spectral Invariants on Singular Spaces, CRM, Canada
- 2012 Jun Inverse Problems Conference in honor of Gunther Uhlmann, UC Irvine
- 2011 Oct Microlocal Methods in Scattering and Spectral Theory, Northwestern University

Teaching Experience:Northeastern:

2024 Spring Math 1342 Calculus II for Science and Engineering Section 2 and Section 8
 2024 Spring Math 7771 Reading in Geometry
 2023 Fall Math 5101 Graduate Analysis I
 2023 Fall Math 7771 Reading in Geometry
 2023 Spring Math 5122 Graduate Geometry I
 2022 Fall Math 7771 Reading in Geometry
 2021 Fall Math 1342 Calculus II for Science and Engineering Section 1 and Section 5
 2020 Fall Math 1342 Calculus II for Science and Engineering Section 1
 2020 Fall Math 5101 Graduate Analysis I: Functions of One Variable

UC Berkeley:

2019 Spring Math 104 Introduction to Analysis Section 2 & 3, lecturer
 2018 Fall Math 104 Introduction to Analysis Section 6, lecturer

Stanford:

2018 Spring MATH 205C Graduate Real Analysis, lecturer
 2018 Spring MATH 171 Fundamental Concepts of Analysis, lecturer
 2017 Winter MATH 20 Introductory Calculus, lecturer
 2017 Winter MATH 131P Partial Differential Equations I, lecturer
 2016 Winter MATH 20 Introductory Calculus, lecturer
 2016 Fall MATH 171 Fundamental Concepts of Analysis, lecturer
 2015 Winter MATH 131P Partial Differential Equations I, lecturer
 2015 Fall MATH 131P Partial Differential Equations I, lecturer
 2015 Fall MATH 175 Functional Analysis, lecturer

MIT:

2020 Spring 18.03 Differential Equations, recitation instructor and course administrator
 2015 Summer 18.089 Review of Mathematics, lecturer
 2014 Spring 18.06 Linear Algebra, recitation instructor and course administrator
 2013 Fall 18.01 Calculus, recitation instructor and course administrator
 2013 Spring 18.100C Real Analysis, course assistant
 2012 Fall 18.01A/02A Calculus, recitation instructor

Mentoring and Advising:

2021 – PhD advising:
 Xuezhu Lu (co-advising with Ting Zhou, 2021-2023)
 Xin Shen (co-advising with Ting Zhou, 2023-)
 Alia Yusaini (2023-)
 2022 - Undergraduate & Master Research Advising:
 Nick Payne (2022 Spring - 2023 Spring)
 Molly Sager (2023 Fall - 2024 Spring, undergraduate thesis advisor)
 2022 - Undergraduate thesis committee member:
 Zhenxun Liu (2022)

- 2021 - First-year graduate student mentor:
 Connor Anderson (2021-2022)
 Hongqin Zou (2022-2023)
 Alia Yusaini (2023-2024)
- 2021 - Department of Mathematics Graduate Student Mentoring Program, Mentor:
 Changchang Liu, Esha Srivastava (2021-2022)
 Haolin Ji (2022-2023)
 Jared Hutchison, Vandan Pokal, Shixu Luo (2023-2024)
- 2014 Winter Directed Reading Program (DRP)
- 2014 Summer Summer Program in Undergraduate Research (SPUR), MIT, preprints available
- 2013 Winter Directed Reading Program (DRP)
- 2012 Summer Summer Program in Undergraduate Research (SPUR), MIT, project results available at <http://math.mit.edu/research/undergraduate/spur>

Outreach:

- 2023 – Faculty advisor, Graduate Women-in-Math at Northeastern
- 2021 – Organizer, Graduate student mentoring program in Mathematics Department
- 2021 Dec: Academic Career Panel
- 2022 Mar: Industry Career Panel (virtual)
- 2022 Oct: Kick-off Dinner
- 2022 Nov: PhD/Postdoc Application Lunch Panel
- 2023 Feb: Mid-year Lunch
- 2023 Apr: End-of-Year Lunch
- 2023 Oct: kick-off lunch
- 2023 Oct: PhD/Postdoc Application Virtual Panel
- 2024 Feb: Industry Career Virtual Panel
- 2024 Apr: Speed-mentoring Lunch
- 2021 – Faculty advisor, AWM Northeastern University Chapter
- 2020 – Founder and faculty advisor, Northeastern University MathEMA (Mathematics Engagement and Mentorship Association)
- 2021 Faculty reviewer, New England Future Faculty Workshop
- 2019 Fall Panelist, MSRI Connection for Women Workshop
- 2016 – 2017 Organizer, Stanford Women in Math
- 2013 – 2015 Organizer, MIT Friends of the Arts
- 2011 – 2013 Chair, Graduate Women of MIT Mentoring Program

Service:

- 2018 – Referee: Int. Math. Res. Not, J Geom Anal, Proc. Am. Math. Soc, Adv. Math., Contemporary Mathematics series of the AMS, J.Éc. polytech. Math, Scientific Report
- 2023 Co-organizer, Math REU program
- 2021 Outside reviewer, NSERC
- 2023 - 2024 Member, Undergraduate research committee
- 2020 - 2024 Member, INVEST hiring committee
- 2020 - 2024 Member, Department of Mathematics Graduate Committee

- 2020 Panelist, NSF-DMS
- 2014 – 2015 Organizer, Graduate Student Analysis Seminar

Miscellaneous experiences:

- 2013 Quantitative Research Intern, Citadel
- 2009 Undergraduate Researcher, Oakland University