Zhizhang Xie

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Research interests

Noncommutative geometry, K-theory of operator algebras, index theory, and their applications to geometry and topology

Education

2005–2011	**Ph.D in Mathematics**, Ohio State University
	Advisor: Henri Moscovici
	Thesis: Analogues of eta invariants for even dimensional manifolds
2001–2005	**B.S. in Mathematics**, Zhejiang University (China)
	Advisor: Shiu-Chun Wong

Positions

2023– present	**Professor**, Texas A&M University
2018–2023	**Associate Professor**, Texas A&M University
2013–2018	**Assistant Professor**, Texas A&M University
2011–2013	**Assistant Professor** (non-tenure-track), Vanderbilt University

Grants

- NSF DMS-2247322 (PI) K-theory of Operator Algebras and Index Theory on Spaces of Singularities, 08/01/2023–07/31/2026, $245,803

- NSF DMS-1952693 (PI) FRG: the hypoelliptic Laplacian, noncommutative geometry and applications to representations and singular spaces, 06/01/2020–05/31/2024, $405,557

- NSF DMS-2400112 (PI) Collaborative Research: Conference: Brazos Analysis Seminar, 04/01/2024–03/31/2027, $16,400

- NSF DMS-2350508 Co-PI (with A. Song (PI), Z. An, and S. Cecchini) Conference: Noncommutative Geometry and Analysis, 03/01/2024–02/28/2025, $30,000

- NSF DMS-2350250 Co-PI (with T. Yang (PI), S. Gong, and M. Willis) Conference: Quantum Topology, Quantum Information and connections to Mathematical Physics, 05/01/2024–04/30/2025, $40,000

- NSF DMS-2000335 (PI), Young Mathematicians in C^*-Algebras 2020, 06/01/2020–05/31/2023, $31,454

- NSF DMS-1800737 (PI), K-theory of Operator Algebras and Invariants of Elliptic Operators, 07/01/2018–06/30/2022, $196,506

- NSF DMS-1900745, Co-PI, (with K. Dykema (PI) and M. Anshelevich, D. Kerr, M. Brannan) Great Plains Operator Theory Symposium 2019, $49,999

- NSF DMS-1800780 (PI) with G. Yu (Co-PI), International Workshop on Operator Theory and its Applications 2018, 2018–2020, $40,000

- NSF DMS-1500823 (PI), K-Theory of Operator Algebras and Invariants of Elliptic Operators, 07/01/2015–06/30/2019, $120,000

- NSF DMS-1430907 Co-PI, (with G. Yu (PI) and B. Ćaćić), Noncommutative Geometry Festival, 2014–2015, $39,100

- AMS-Simons Travel Grant, 2013–2015, $4,000

Papers

- (with J. Wang) Scalar curvature rigidity of degenerate warped product spaces, *Trans. Amer. Math. Soc. Ser. B* 12 (2025), 1-37.

- (with J. Wang, B. Zhu and X. Zhu) Positive scalar curvature meets Ricci limit spaces, *Manuscripta Math.* 175 (2024), no. 3-4, 943-969.

- (with S. Weinberger and G. Yu) On Gromov's compactness question regarding positive scalar curvature, *Ann. K-Theory* 9 (2024), no. 4, 583-612.

- (With J. Deng, G. Tian and G. Yu) K-theory of relative group C*-algebras and the relative Novikov conjecture, *Math. Z.* 306 (2024), no.3, Paper No. 45, 38 pp.

- (with J. Wang and G. Yu) A proof of Gromov's cube inequality on scalar curvature, *J. Differential Geom.* 128 (2024), no. 3, 1285–1300.

- (with J. Wang and G. Yu) Decay of scalar curvature on uniformly contractible manifolds with finite asymptotic dimension, *Comm. Pure Appl. Math.* 77 (2024), no. 1, 372–440.

- (with X. Chen, J. Wang and G. Yu) Delocalized eta invariants, cyclic cohomology and higher rho invariants, *Ann. K-Theory* 8 (2023), no. 4, 531–608.

- A quantitative relative index theorem and Gromov's conjectures on positive scalar curvature, *Journal of Noncommutative Geometry*, 17 (2023), no. 2, 609–662.

- (with J. Wang and G. Yu) Approximations of delocalized eta invariants by their finite analogues, *L'Enseignement mathématique*, 69 (2023), no. 1-2, 51–91.

- (with J. Wang and G. Yu) ℓ^1-higher index, ℓ^1-higher rho invariant and cyclic cohomology, *Proceedings of Symposia in Pure Mathematics – Cyclic Cohomology at 40: Achievements and Future Prospects*, pages 535–579, 2023

- (With H. Guo and G. Yu) Quantitative K-theory, positive scalar curvature, and band width, *Perspectives on Scalar Curvature* (editors: Gromov and Lawson), pages 763–798, 2023.

- (with H. Guo and G. Yu) A Lichnerowicz vanishing theorem for the maximal Roe algebra, *Math. Ann.* 385 (2023), no. 1–2, 717–743.

- (with G. Yu and R. Zeidler) On the range of the relative higher index and the higher rho-invariant for positive scalar curvature, *Adv. Math.* 390 (2021), Paper No. 107897.

- (With H. Guo and G. Yu) Functoriality for higher rho invariants of elliptic operators, *J. Funct. Anal.* 280 (2021), no. 10, Paper No. 108966, 36 pp.

- (with S. Weinberger and G. Yu) Additivity of higher rho invariants and nonrigidity of topological manifolds, *Comm. Pure Appl. Math.* 74 (2021), no. 1, 3–113.

- (with G. Yu) Higher invariants in noncommutative geometry, *Advances in Noncommutative Geometry - On the Occasion of Alain Connes' 70th Birthday*, 2019

- (with G. Yu) Delocalized eta invariants, algebraicity, and K-theory of group C^*-algebras, *Int. Math. Res. Not. IMRN* 2021, no. 15, 11731–11766.

- (with A. Gorokhovsky) Fibrations and higher products in cohomology, *J. Topol. Anal.* 11 (2019), no. 1, 135–147.

- (with A. Gorokhovsky and D. Sullivan) Generalized Euler classes, differential forms and commutative DGAs, *J. Topol. Anal.* 11 (2019), no. 1, 109–118.

- (with N. Higson and T. Schick) C^*-algebraic higher signatures and an invariance theorem in codimension two, *Geom. Topol.* 22 (2018), no. 6, 3671–3699.

- (with G. Yu) Higher rho invariants and the moduli space of positive scalar curvature metrics, *Adv. Math.* 307 (2016), 1046–1069.

- (with G. Yu) Noncommutative geometry of discrete groups, in *Introduction to Modern Mathematics*, ALM 33, Higher Education Press and International Press, Beijing-Boston, 2015

- (with G. Yu) Positive scalar curvature, higher rho invariants and localization algebras, *Adv. Math.* 262 (2014), 823–866.

- (with G. Yu) A relative higher index theorem, diffeomorphisms and positive scalar curvature, *Adv. Math.* Vol. 250 (2014), 35–73.

- The odd dimensional analogue of a theorem of Getzler and Wu, *J. Noncommut. Geom.* 7 (2013), no. 3, 647–676.

- Relative index paring and odd index theorem for even dimensional manifolds, *Journal of Functional Analysis*, 260 (2011), no. 7, 2064–2085.

Preprints & Drafts

- (With J. Wang, G. Yu and B. Zhu) ℓ^P-coarse Baum–Connes conjecture for ℓ^q-coarse embeddable spaces

- (with J. Wang) Scalar curvature rigidity of spheres with subsets removed and L^∞ metrics

- (With S. Cecchini, J. Wang and B. Zhu) Scalar curvature rigidity of the four-dimensional sphere

- (With J. Wang, G. Yu and B. Zhu) Filling Radius, Quantitative K-theory and Positive Scalar Curvature

- (with S. Gong, J. Wu and G. Yu) The Novikov conjecture, the group of diffeomorphisms and continuous fields of Hilbert-Hadamard spaces

- (with J. Wang) Dihedral rigidity for submanifolds of warped product manifolds

- (with J. Wang) On Gromov's flat corner domination conjecture and Stoker's conjecture

- (with J. Wang and G. Yu) On Gromov's dihedral extremality and rigidity conjectures

- (with N. Higson) Higher signatures of Witt spaces

- (with J. Deng, G. Tian and G. Yu) Novikov conjecture for groups generated by coarsely embeddable groups under extensions and direct limits

- (with G. Tian and G. Yu) Relative Novikov conjecture for coarsely embeddable groups

Invited conference talks

2025

- 2025 AMS Fall Central Sectional Meeting: special session on "Noncommutative Geometry and Applications", St. Louis (October 2025)
- Geometry and Convergence in Mathematical General Relativity, Simons Center, Stony Brook (September 2025)
- The 4th Australia-China-Japan-Singapore-US Index Theory Conference – Analysis and Geometry on Manifolds, Singapore (August 2025)

- The 2025 Spring Texas Geometry and Topology Conference, Houston (April 2025)
- Workshop: Canonical Metrics in Differential Geometry, Madison (April 2025)
- International Congress of Chinese Mathematicians, Shanghai (January 2025)

2024

- Special Week on Operator Algebras, ECNU, Shanghai (July)
- CHallenges in ANalysis and GEometry, ETH Zürich (June)

2023

- Wabash Mini-Conference, Indianapolis (September/October)
- International Conference on Noncommutative Geometry, Qinhuangdao (August)
- Noncommutative Geometry Festival 2023, Washington University in St. Louis (June)
- Perspective Lecture at Index Theory Conference – Noncommutative Geometry and K-Theory, Tokyo (May–June)
- Plenary speaker at the 2023 Canadian Operator Symposium, University of Western Ontario (May)
- Discrete and computational geometry, shape analysis, and applications, Rutgers University (May)

2022

- NSF-CBMS Conference: K-theory of operator algebras and its applications to geometry and topology, University of Puerto Rico (August)
- Oberwolfach Workshop on Non-Commutative Geometry and Cyclic Homology, Germany (July–August)
- Workshop on Recent Advances on Scalar Curvature Problems, Simons Center for Geometry and Physics (June–July)
- Plenary lecture at GPOTS 2022, Washington University at St. Louis (May)
- Lecture series at General Relativity Workshop: Scalar Curvature and Minimal Surfaces, CMSA at Harvard University (May)

2021

- Conference on Index Theory and Related Topics (online, August)

- Oberwolfach Workshop on Analysis, Geometry and Topology of Positive Scalar Curvature Metrics (online, June–July)

2020

- Oberwolfach workshop on noncommutative geometry (online, June–July)

2019

- East Coast Operator Algebra Symposium 2019, Ohio State University (October)
- International Congress of Chinese Mathematicians, Beijing (June)
- Index Theory, Duality and Related Fields, Tianjin (June)
- Operator K-Theory in Geometry, Topology and Representation Theory (Gennadi Kasparov 70), Kyoto (June)
- K-theory and Noncommutative Geometry, Shanghai (June)
- Noncommutative Geometry Festival 2019, WSTL (April)
- AMS special session on "Coarse geometry, index theory, and operator algebras: around the mathematics of John Roe", Honolulu (March)

2018

- Symposium on K-theory and noncommutative topology, San Juan (October)
- semi-Plenary speaker, International Workshop on Operator Theory and its Applications, Shanghai (July)
- Oberwolfach workshop on noncommutative geometry, Germany (July)
- Workshop on Secondary and delocalized index invariants, Copenhagen (June)

2017

- Australia-China conference in noncommutative geometry and related areas, University of Adelaide (December)
- Functional Analysis Conference, Fudan University (July)
- Mathematical Congress of the Americas, special session on Discrete Groups and Operator Algebras, Montreal (July)
- SUMIRFAS, Texas A&M University (July)
- mini course at Summer School on Operator Algebras and Noncommutative Geometry, Hebei Normal University (July)

- 2017 Spring Program on Operator Algebras, East China Normal University (April)
- Noncommutative Geometry conference in Honor of Alain Connes' 70th Birthday: Index Theory and its Ramifications in Geometry, Topology and Physics, Fudan University (March)

2016

- AMS special session on Noncommutative Geometry and Fundamental Applications, Denver, (October)
- Workshop: the Farrell-Jones conjecture, Bonn (October)
- Invited lecture series, Fudan University (July)
- Conference on Surgery and Geometry, Banff Center (July)
- Special Week on Operator Algebra, East China Normal University (June)

2015

- Noncommutative Dimension Theories, Hawaii (November)
- Oberwolfach workshop on noncommutative geometry, Germany (June)
- Special Week on Operator Algebras, East China Normal University (June)
- Operator Algebra and Harmonic Analysis, Tsinghua Sanya International Mathematics Forum (May)

2014

- West Coast Operator Algebra Seminar, Denver, Boulder (November)
- Trimester Program: Noncommutative Geometry and its Applications, Bonn, Germany (September-December)
- Special Week on Operator Algebras, Shanghai, China (August)
- Analysis and Topology in Interaction, Cortona, Italy (June)
- Banach methods in Noncommutative Geometry, Wuhan University (June)
- Geometric Structures and Spectral Invariants, Berlin, Germany (May)
- Noncommutative Geometry Festival, Texas A&M University (April&May)

2013

- Further development of Atiyah-Singer index theorem and K-theory, Kyoto University (December)

- ECOAS, University of Cincinnati (October)

- Wabash conference, IUPUI (October)

- Oberwolfach workshop on noncommutative geometry, Germany (September)

- Concentration week in Dynamics, Geometry, and Operator Algebras, Texas A&M University (August)

- Summer school on noncommutative geometry and operator algebras, Fudan University, China (July)

- Special session on noncommutative geometry and geometric analysis at AMS sectional meeting, University of Colorado at Boulder (April)

- Discrete geometry and dynamical systems conference, Kyoto University, Japan (January)

2010 - 2012

- Analysis and geometry conference, Université Paris 6, France (December, 2012)

- Geometric group theory and K-Theory conference, Kyoto University, Japan (June, 2012)

- Topology and functional analysis conference, Fudan University, China (May, 2012)

- Mini-course on APS index theorem and Connes-Chern character, 9th annual spring institute on noncommutative geometry and operator algebras, Vanderbilt University (May 2011)

- Oberwolfach workshop on analysis and geometric singularities, Germany (July 2010)

- Noncommutative geometry session of CMS summer meeting, University of New Brunswick, Canada (June 2010)

Invited seminar and colloquium talks

○ Colloquium, Texas Christian University (November 2025)

○ Geometry Seminar, Rice University (Feb 2025)

○ Colloquium, SUNY at Albany (October 2024)

○ Not Only Scalar Curvature Seminar (Feb 2024)

- Differential Geometry & Geometric Analysis Seminar, Princeton University (September 2023)

- Geometric Analysis Seminar, University of Chicago (December 2022)

- Differential Geometry Seminar, UC Berkeley (April 2022)

- Not Only Scalar Curvature Seminar (April 2022)

- The Global Noncommutative Geometry Seminar (February 2022)

- Baylor Analysis Seminar (October 2021)

- The Global Noncommutative Geometry Seminar (May 2021)

- Oberseminar C^*-algebras (April 2021)

- The Global Noncommutative Geometry Seminar (May 2020)

- Wabash Modern Analysis Seminar, Wabash College (February 2020)

- Analysis seminar, UIUC (February 2020)

- Analysis seminar, University of Houston (April 2018)

- Colloquium, Texas Christian University (September 2018)

- Invited lecture, East China Normal University (August 2017)

- Analysis seminar, Baylor University (April 2016)

- Noncommutative geometry seminar, Texas A&M University (March 2016)

- Invited lecture, East China Normal University (August 2015)

- Introductory talk for undergrads, Fudan University (July 2015)

- Invited lecture, Chongqing University (June 2015)

- Analysis seminar, SUNY Buffalo (April 2015)

- Noncommutative Geometry Seminar, Penn State (March 2015)

- Differential Geometry Seminar, UC Santa Barbara (February 2015)

- Noncommutative Geometry Seminar, Texas A&M University (January 2015)

- Geometry and Topology Seminar, Free University of Berlin (December 2014)

- Topology Seminar, Ohio State University (November 2014)

- Noncommutative geometry seminar, Texas A&M University (November 2014)

- Noncommutative geometry seminar, Texas A&M University (October 2014)

- Kyoto operator algebra seminar, Kyoto University (December 2013)

- Geometry seminar, Texas A&M University (December 2013)

- Groups and Dynamics seminar, Texas A&M University (October 2013)

- Noncommutative geometry seminar, Texas A&M University (October 2013)

- Linear analysis seminar, Texas A&M University (April 2013)

- Colloquium talk, University of Göttingen, Germany (November 2012)

- Global analysis research seminar, University of Bonn, Germany (October 2012)

- Seminar on operator algebras, Université Paris 7, France (September 2012)

- Noncommutative geometry seminar, Vanderbilt University (February 2012)

- Noncommutative geometry seminar, Vanderbilt University (September 2011)

- Colloquium talk, University of Colorado at Boulder (Spring 2011)

- Algebraic geometry Seminar, Ohio State University (October 2007)

Organizational activities

- founder and co-organizer of the workshop series MAGEC: *Meeting on Analysis and noncommutative Geometry for Early Career researchers* (formerly known as Young Mathematicians in Noncommutative Geometry and Analysis). This is an annual workshop with a goal of fostering scientific and social interaction among young mathematicians in various different branches of mathematics (in particular for those who work in index theory, noncommutative geometry, functional analysis and geometric analysis).

- co-organizer of *Noncommutative Geometry Festival* (an annual conference series on Noncommutative Geometry)

- co-organizer of *Brazos Analysis Seminar* (a regional semi-annual seminar series among Baylor University, Texas A&M University, Texas Christian University, the University of Houston and the University of Texas at Tyler)

- co-organizer of *Noncommmutative Geometry Seminar* at Texas A&M University (since 2013)

- co-organizer of Colombia Winter School on Noncommutative Geometry and Geometric Analysis (November 2022)

- co-organizer of Online Seminar on the Hypoelliptic Laplacian and Noncommutative Geometry (since March 2020)

- co-organizer of Great Plains Operator Theory Symposium 2019 (May 28 - June 1, 2019)

- co-organizer of Noncommutative geometry and index theory for group actions and singular spaces (May 21 - 25, 2018)

- co-organizer of special session on Noncommutative Geometry at International Workshop on Operator Theory and its Applications (July 23 - 27, 2018)

- co-organizer of special session on Noncommutative Geometry and Quantization, Mathematical Congress of the Americas (July 24 - 28, 2017)

- co-organizer of Noncommutative Geometry conference in Honor of Alain Connes' 70th Birthday, Shanghai University (May 23 - April 7th, 2017)

- co-organizer of Noncommutative Geometry Festival 2015 at Ohio State University (May 3 - 5, 2015)

- co-organizer of Noncommutative Geometry Festival at Texas A&M University (April 30 - May 3, 2014)

- co-organizer of The 11th Annual Spring Institute on NCGOA at Vanderbilt University (May 2013)

- co-organizer of Noncommutative Geometry Seminar at Vanderbilt University (2011 - 2013)

Editorial Service

- Editor: Journal of Topology and Analysis

Professional activities and services

- Postdocs: Jianchao Wu, Jinmin Wang, Bo Zhu, Runjie Hu

- PhD students: Mingyu Liu (2021), Sheagon John (2022), Alexander Weygandt (2024), Milan Jovanovic, Alexandros Kazantzidis

- Master's degree students: Qinfeng Zhu (2018)

Outreach

- Program for Research in Mathematics (for high school students)

- teaching Advanced Problem Solving sessions at Math Circle

Teaching at Texas A&M University

The full list of courses that I have taught can be found at the following link.
`https://zhizhangxie.github.io/teaching.html`