Geonhee (Gunhee) Cho

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https://sites.google.com/view/enjoyingmath/home

RESEARCH INTEREST

Complex Geometry and Several Complex Variables, Quantum Computing, Riemannian geometry, sub-Riemannian geometry, Probability, Optimal transport and Information Geometry

EMPLOYMENT

July 2025 - Present
Tenure Track Assistant Professor, Texas State University, TX, USA.

June 2024 - June 2025
Lecturer, Texas State University, TX, USA.

July 2021 - June 2024
Visiting Assistant Professor, University of California, Santa Barbara, CA, USA.
Mentor : Guofang Wei

EDUCATION

Ph. D. Mathematics — May 2021
University of Connecticut, CT, United States (Advisor : Damin Wu)
Thesis : Topics of Invariant metrics in hyperbolic complex geometry

M. Sc. Mathematics (Graduate Representative Graduation) — Aug 2012
Sogang University, Seoul, Korea

B. Eng. Mechanical engineering (Ranked first in my graduating class) — Aug 2010
Sogang University, Seoul, Korea

WORKING EXPERIENCE

Technical Research Personnel for a Military-Service, Software-Engineer — 2012-2016
MKS-KOREA, Inc., Daejeon, S.Korea

PUBLICATIONS IN MATH

1. Diameter theorems on Kähler and quaternionic Kähler manifolds under a positive lower curvature bound (with M. Gordina), **Differential Geometry and Its Applications**, 10.1016/j.difgeo.2024.102218, 22 pp.
2. Probabilistic Method to Fundamental Gap Problems on the Sphere (with G. Wei, G. Yang), **Transactions of the American Mathematical Society**, 10.1090/tran/9285, 20 pp.
3. The stochastic Schwarz lemma on Kähler manifolds by couplings and its applications (with M. Chae, M. Gordina, G. Yang), **Journal of the London Mathematical Society**, 10.1112/jlms.12849, 23 pp.
4. Equivalence of invariant metrics via Bergman kernel on complete noncompact Kähler manifolds (with K. Lee), **Mathematische Annalen**, 10.1007/s00208-023-02735-2, 31 pp.

5. Non-existence of complete Kähler metric of negatively pinched holomorphic sectional curvature, **Complex Analysis and its Synergies**, 10.1007/s40627-023-00119-5, 9(2023), no.2, Paper No. 9, 6 pp.
6. Vanishing results from Lichnerowicz Laplacian on complete Kähler manifolds and applications (with Nguyen Thac Dung), **Journal of Mathematical Analysis and Applications**, 10.1016/j.jmaa.2022.126602, 517(2023), no.1, Paper No. 126602, 15 pp.
7. Sub-Riemannian Geodesics on $SL(2,\mathbb{R})$ (with D. D'Alessandro), **ESAIM: Control, Optimisation and Calculus of Variations**, 10.1051/cocv/2022068, 28(2022), Paper No. 76, 30 pp.
8. Bergman metric on the symmetrized bidisc and its consequences (with Y. Yuan), **International Journal of Mathematics**, 10.1142/S0129167X22500719, 33(2022), no.10–11, Paper No. 2250071, 16 pp.
9. A note on first eigenvalue estimates by coupling methods in Kähler and quaternionic Kähler manifolds (with F. Baudoin, G. Yang), **Electronic Communications in Probability**, 10.1214/22-ECP452, 27(2022), Paper No. 12, 8 pp.
10. Comparing the Carathéodory pseudo-distance and the Kähler–Einstein distance on complete Reinhardt domains, **Asian Journal of Mathematics**, 10.4310/AJM.2022.v26.n1.a2, 26(2022), no.1, 7 pp.
11. Octonionic Brownian Windings (with G. Yang), **Journal of Theoretical Probability**, 10.1007/s10959-021-01127-z, 35(2022), no.3, 17 pp.
12. The subelliptic heat kernel of octonionic anti-de Sitter fibration (with F. Baudoin), **SIGMA: Symmetry, Integrability and Geometry: Methods and Applications**, 10.3842/SIGMA.2021.014, 17(2021), Paper No. 014, 9 pp.
13. The subelliptic heat kernel on the octonionic Hopf fibration (with F. Baudoin), **Potential Analysis**, 10.1007/s11118-020-09854-4, 55(2021), no.2, 17 pp.
14. Invariant metrics on the complex ellipsoid, **Journal of Geometric Analysis**, 10.1007/s12220-019-00333-w, 31(2021), no.2, 16 pp.
15. The Kobayashi–Royden metric on punctured spheres (with J. Qian), **Forum Mathematicum**, 10.1515/forum-2019-0297, 32(2020), no.4, 7 pp.

PREPRINTS IN MATH

1. Sharp lower bounds for the first eigenvalue of Steklov-type eigenvalue problems on a compact surface (with K. Seo), arXiv:2506.21376, submitted, 13 pp.
2. Non Measure-Hyperbolicity of K3 surfaces and Hilbert scheme of points of K3 surface (with D. R. Morrison), arXiv:2307.04288, submitted, 15 pp.
3. The statistic Bergman geometry (with J. Yum), arXiv:2305.10207, submitted, 41 pp.
4. Sharp Weighted CR Trace Sobolev Inequalities (with Z. Yan), arXiv:2304.06874, submitted, 25 pp.
5. Deformation of a hyperbolic embedding into the projective toric variety (with J. Yoo), arXiv:2111.02192, revising, 30 pp.
6. Rigidity results with curvature conditions from Lichnerowicz Laplacian and applications (with N. T. Dung, T. Q. Huy), arXiv:2111.07496, revising, 20 pp.

PROJECTS IN QUANTUM COMPUTING AND HARDWARE

All manuscripts below are *in preparation*, with drafts completed and *available upon request*.

1. Variational Quantum Eigensolvers via Weighted Projective Lines: Modeling Nonstationary Noise and Adaptive Optimization,
   Gunhee Cho, Jessie Wang, Angela Yue.
   HSMC Undergraduate Team Mentoring Project, Summer 2025.
2. Weighted Projective Line ZX-Calculus for Surface Code Error Analysis and Circuit Compression,
   Gunhee Cho, Jason Cheng, Evelyn Li.
   HSMC Undergraduate Team Mentoring Project, Summer 2025.
3. Scalable Quantum LDPC Codes from Toric Geometry with Transversal CCZ Gates, Gunhee Cho, Jeongwoo Jae. *Quantum Error Correcting Codes (QECC).*
4. Lightweight and Verifiable Surface Code Decoding from Toric Geometry to iCEstick FPGA, Gunhee Cho, Jeongwoo Jae. *Quantum Error Correcting Codes (QECC).*
5. Reinforcement Learning of Quantum States via Wasserstein Gradient Flow: Theory, Hybrid Algorithms, and NISQ Applications, Gunhee Cho, Jeongwoo Jae, Hyun Lee. *Quantum Machine Learning (QML).*
6. Reduced Scalar Curvature from Partial Trace: A Geometric Framework for Efficient VQE Optimization, Gunhee Cho, Jeongwoo Jae. *Quantum Machine Learning (QML).*
7. Development of a high-speed impedance measurement system for dual-frequency capacitive-coupled pulsed plasma (second author), **Review of Scientific Instruments**, 10.1063/1.4928121, 86(2015), no.8, Paper No. 083505.

AWARDS AND GRANT SUPPORT

AMS Simon Travel Grant	07/22-07/25
Michael Neumann Dissertation Award	Spring 2021
Uconn Doctoral Dissertation Fellowship	Fall 2020
Uconn Predoctoral Fellowship	Fall 2020
Uconn Summer Fellowship	Summer 2019
Uconn Provost Excellence in Teaching	Spring 2018
Brain Korea 21 Program for Leading Universities & Students	2010-2012
Scholarship of Academic Achievement	2007-2009

ACADEMIC ACTIVITIES

Reviewer for Mathscinet	2021-2023
Referee of Proceeding of AMS, J of Geometric Analysis	2021-2022
Referee of Pacific J of Mathematics, Acta Mathematica Scientia	2022-2023
Referee of International J of Math, J of Geometric Analysis	2023-2024
Co-organizer of Differential geometry seminar,UCSB	2021-2024
Co-organizer of Ricci curvature Reading group, UCSB	2021-2022
Co-organizer of Optimal Transport and Geometry Reading group, UCSB	2022-2023
Organizer of Information Geometry Reading group, UCSB	Fall 2023
Co-organizer of Complex and CR geometry seminar, UCSB	2023-2024

TEACHING EXPERIENCE

Texas State University

Math 3383 Numerical Analysis 1	Fall 2025
Math 2393 Multivariable Calculus	Summer 2025
Math 2417 Pre-calculus	Spring 2025
Math 1329 Math for Business and Economics 2	Spring 2025

Math 1319 Math for Business and Economics 1	Fall 2024
Math 1329 Math for Business and Economics 2	Fall 2024

University of California, Santa Barbara

Math 4B Elementary Differential Equations	Spring 2023
Math 6B Multivariable Calculus 2	Winter 2023
Math 6A, Math 8	Fall 2022
Math 124A Partial Differential Equations	Summer B 2022
Math 147A Introduction to Differential Geometry	Summer B 2022
Math 8 Transition to Higher Mathematics	Summer A 2022
Math 4B Elementary Differential Equations	Spring 2022
Math 6A Multivariable Calculus 1	Winter 2022
Math 6A Math 8	Fall 2021

University of Connecticut

Math1132 Calculus II Discussion	Fall 2020
Official Graduate prelim exam(Qualifying exam) TA	Summer 2020
Math2410 Elementary Differential Equations (Primary instructor)	Spring 2020
Math2110 Multivariable Calculus Discussion	Fall 2019
Math2410 Elementary Differential Equations (Primary instructor)	Spring 2019
Math1132 Calculus II Discussion	Fall 2018
Math1132 Calculus II Discussion	Spring 2018
Math2110 Multivariable Calculus Discussion	Fall 2017
Math1132 Calculus II Discussion	Spring 2017

YOUTUBE ACTIVITIES

Enjoying Math Channel (Mostly communicating in Korean)

From basic to graduate school mathematics: Set theory, Real analysis, Linear algebra, General topology, Abstract algebra, Measure theory, Multivariable calculus for math major	2019-2024
Mathematics for office workers and liberal arts students: Introduction to set theory, group theory, linear algebra, calculus, topology, differential geometry, complex analysis, and statistics for the general public	2021-22, 2022-23, 2023-24
Mathematics for machine learning and applied researchers: Introduction to Information geometry, machine learning and optimization, stochastic calculus and financial statistics for applied researchers	2022-2023
Mathematical perspective gained based on Riemann's complex analysis	2023-2024
Information Geometry and Statistics	2022-2024
The beauty of algebra from concrete to abstract	2024-2025
Optimization and Stochastic process	2024-2025
Category theory and Functional programming	2024-2025
Reinforcement learning and optimization based on Super Mario Open-AI	2024-2025
Riemannian geometry and Ricci flow	2021-2024
Differential Geometry for Engineers	2019-2020
Complex Algebraic geometry	2020-2024
Quantum computing and Complex geometry	2024-2025
Mathematics for engineering students	2023-2025
Mathematics for absolute beginners	2023-2025

GRAD MENTORING

Elanchearan R S (IIT Madras), Invariant metrics on Symmetrized Polydisk 2023-2025

UNDERGRAD MENTORING

James McNeice, Senior Thesis, Introduction to the Hopf Conjecture 2022-2023
Daniel Badilla, James McNeice, Ran Ji, Direct Reading Program with Poster Session, An Introduction to Information geometry 2022-2023
Sammy Suliman, Senior Thesis, EM algorithm in Information Geometry 2023-2024

INVITED TALKS

Colloquium, Univ of North Carolina at Charlotte Oct 2024
Topology Seminar, Texas State Univ Sep 2024
Junior Workshop in SCV, Wisconsin-Madison, June 2024
Colloquium, CalState Apr 2024
Probability seminar, UC-SanDiego, Nov 2023
ICTP Summer School on Differential Geometry, VIASM, Vietnam, Aug 2023
Young Mathematician workshops in SCV, PNU, S. Korea, Aug 2023
Complex geometry seminar, IBS-Daejeon, Aug 2023
Differential geometry seminar, Caltech, May 2023
Differential geometry seminar, UC-Irvine, May 2023
Quasi-Einstein manifold seminar
Banff International Research Station, *CA* Apri 2023
Differential geometry seminar KIAS, *Virtual* Dec 2022
Analysis and PDE seminar *Univiersitetet i Bergen, Norway (Virtual)* Nov 2022
Northeast Workshop in Geometric Analysis Conference *UConn, CT* Nov 2022
PDE and Differential Geometry seminar *UConn, CT* Sep 2022
Young Mathematicians workshops in SCV *Wuhan Univ (Virtual meeting)* Aug 2022
Joint Mathematical Meeting *Virtual meeting* Apr 2022
Geometric Analysis Seminar *Iowa State Univ* Mar 2022
Complex Geometry seminar *IBS Center for CG, S. Korea* Feb 2022
Differential Geometry seminar *UCSD, San Diego, CA* Feb 2022
Several Complex Variable seminar *IBS Center for CG, S. Korea* Jan 2022
Mathematics Colloquium *Iowa State Univ* Nov 2021
AMS Western Sectional meeting *Univ of New Mexico* Oct 2021
Differential geometry seminar UCSB, *Santa Barbara, CA* July 2021
Differential geometry seminar KIAS, *Seoul S. Korea* July 2021
Complex geometry seminar Handong University, *Pohang, S. Korea* May 2021
z-Seminar on Complex Analysis and Geometry
POSTECH, *Pohang, S.Korea* Mar 2021
Stochastic and Geometry online conference
Banff International Research Station, *CA* Mar 2021