





Gabriel Khan

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EMPLOYMENT

IOWA STATE UNIVERSITY Ames, Iowa
Assistant Professor, August 2020 to Present

UNIVERSITY OF MICHIGAN Ann Arbor, Michigan
Postdoctoral Research Fellow, May 2018 to July 2020
Mentor: Jun Zhang

THE OHIO STATE UNIVERSITY Columbus, Ohio
Ph.D, Mathematics, May 2018
Masters, Mathematics, May 2015
Advisor: Fangyang Zheng
Thesis: *On the Hermitian Geometry of k -Gauduchon Orthogonal Complex Structures*

BOSTON UNIVERSITY Boston, Massachusetts
B.A. in Mathematics with distinction, Minor in Physics, magna cum laude, May 2012
Advisor: Glen Richard Hall

RESEARCH

RESEARCH GRANTS

1. Simons Collaboration Grant (\$42,000) 2021 - 2026

SCHOLARLY WORKS

1. Spectral Gap Estimates on Conformally Flat Manifolds (M. Tuerkoen). Submitted. Available at arxiv.org/abs/2404.15645
2. Concavity Properties of Solutions of Elliptic Equations under Conformal Deformations (with S. Saha and M. Tuerkoen). Submitted. Available at arxiv.org/abs/2403.03200
3. Interior Hulls of Clean Lattice Parallelograms and Continued Fractions (with M. Khan, R. Khan and P. Zhao). Submitted. Available at arxiv.org/abs/2401.04356
4. Modulus of concavity and fundamental gap estimates on surfaces (with M. Tuerkoen and G. Wei). Submitted. Available at arxiv.org/abs/2306.06053
5. Curvature-torsion entropy for twisted curves under curve shortening flow. Bulletin of Australian Math Society (July 2023). Available at arxiv.org/abs/2305.07171
6. Log-concavity and fundamental gaps on surfaces of positive curvature (with X.H. Nguyen, M. Tuerkoen and G. Wei). arxiv.org/abs/2211.06403

7. Negative curvature constricts the fundamental gap of convex domains (with X.H. Nguyen). Accepted to *Annales Henri Poincaré* (2024). Available at arxiv.org/abs/2211.06404
8. When optimal transport meets information geometry (with J. Zhang). Introduction for a special issue in *Information Geometry*. (June 2022) arxiv.org/abs/2206.14791
9. *An illustrated introduction to Ricci flow* Preprint
10. *A hall of statistical mirrors* (with J. Zhang). *Asian Journal of Mathematics*. arxiv.org/abs/2109.13809
11. *Recent developments on the MTW tensor* (with J. Zhang). Proceedings of the 5th International Conference for Geometric Science of Information.
12. *Kähler-Ricci Flow preserves negative anti-bisectional curvature* (with F. Zheng). arxiv.org/abs/2011.07181
13. *Positively curved Kähler metrics on tube domains and their applications to optimal transport* (with J. Zhang and F. Zheng). To appear in *Math Research Letters*. arxiv.org/abs/2001.06155
14. *The Kähler Geometry of Certain Optimal Transport Problems* (with J. Zhang), *Pure and Applied Analysis* (May 2020). arxiv.org/abs/1812.00032

An extended abstract for these results appeared in the proceedings to the 4th International Conference for Geometric Science of Information under the title *Hessian Curvature and Optimal Transport*.

15. *Connections with torsion in (para-)complexified structures* (with J. Zhang). Contributed chapter to *Progress in Information Geometry: Theory and Applications* (March 2021).
16. *Statistical Mirror Symmetry* (with J. Zhang). *Differential Geometry and its Applications* (August 2020).
17. *A Conjectural Inequality for Visible Points in Lattice Parallelograms* (with M. Khan, J. Saha, and P. Zhao). Proceedings of *Combinatorial and Additive Number Theory IV* (September 2020), arxiv.org/abs/1909.01306
18. *On the Expected Total Curvature of Confined Equilateral Quadrilaterals*. arxiv.org/abs/1902.06316
19. *Eigenvalue estimates without Bakry-Émery-Ricci bounds*. arxiv.org/abs/1901.06277
20. *Weitzenböck Connections as a Generalization of Dually Flat Connections* (with J. Zhang), *Information Geometry* (July 2019)

An extended abstract for these results appeared in the proceedings to the 4th International Conference for Geometric Science of Information under the title *New Geometry of Parametric Statistical Models*.

21. *Hall's Conjecture on Extremal Sets for Random Triangles*, *Journal of Geometric Analysis* (May 2019). arxiv.org/abs/1704.05913
22. *The Set of All Orthogonal Complex Structures on the Flat 6-Tori* (with B. Yang and F. Zheng). *Advances in Mathematics* (August 2017). arxiv.org/abs/1604.05745
23. *Eigenvalues of the Complex Laplacian on compact non-Kähler manifolds*. *Annals of Global Analysis and Geometry* (August 2017). arxiv.org/abs/1512.05044
24. *Revisiting Toom's Proof of Bulgarian Solitaire* (with T. Hart and M. Khan). *Annales des Sciences Mathématiques du Québec* 36(2) (December 2011). arxiv.org/abs/1101.1546

Selected Recorded Lectures

“Statistical Mirror Symmetry” Information Geometry and Affine Differential Geometry IV. Chongqing, China August 2023

“A brief introduction to the regularity theory of optimal transport” Joint Mathematics Meeting. Boston, Massachusetts January 2023

“Optimal Transport and Information Geometry for Data Science and Machine Learning” SIAM Conference on Mathematics of Data Science. UCLA, September 2022

“Hyperbolic Information Geometry” Annual Meeting of the Statistical Society of Canada, Probability Workshop: Information geometry and applications. June 2022

SERVICE

EDITOR

Guest editor for a special issue on optimal transport in *Information Geometry*

GRANT REVIEWER

Simons Foundation Collaboration Grant Program

REFeree/REVIEWER

Information Geometry, Rose-Hulman Undergraduate Mathematics Journal, SIGMA, Pure and Applied Analysis, Journal of Geometry and Physics, Geometriae Dedicata, International Journal of Mathematics, Math Reviews, Zentralblatt

ORGANIZER

Iowa State Geometric Analysis Seminar, Iowa State Math Research Teams (ISMaRT)

VOLUNTEER

2024 Sonia Kovalevsky Day, 2014-2017 Young Mathematician’s Conference, 2017 Harmonic Analysis And Geometry Of Fractal Sets, 2015 Julia Robinson Math Festival, 2013 Young Scholars Program

SELECTED TEACHING AND MENTORING

MENTORING

Soumyajit Saha Postdoctoral scholar	Iowa State University 2022-2024
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ISMaRT project mentor Undergraduate Research Opportunity Program Mentor (University of Michigan)	Spring 2023 & 2024 Fall 2018 - Spring 2020
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TEACHING

IOWA STATE UNIVERSITY

Discrete Math for Business Students	Fall 2023
Calculus 1	Fall 2021
Calculus 2	Fall 2020

Calculus 3	Spring 2022, Fall 2022
Linear Algebra	Fall 2022
Differential Equations	Spring 2021
Introduction to PDEs	Fall 2023
Introduction to Analysis I	Spring 2024
Real Analysis I	Fall 2021
Manifolds, Tensors, and Differential Geometry	Spring 2023

UNIVERSITY OF MICHIGAN

Readings in Information Geometry and Optimal Transport	Fall 2019
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THE OHIO STATE UNIVERSITY

Calculus 1	Fall 2013, Fall 2016, Spring 2017, Fall 2017
Calculus 2	Spring 2014, Spring 2015
Calculus 2 for Engineers	Fall 2015
Calculus 3	Fall 2014
Introduction to ODEs and PDEs for Incoming Masters Students	Summer 2016
Introduction to Statistics for Incoming Masters Students	Summer 2016

OTHER SKILLS

Mathematica	Python
\LaTeX typesetting	Da Vinci Resolve
Adobe Photoshop	Triathlon (USAT All-American 2017)
Geogebra	

Last updated: April 30, 2024