

YUCHEN LIU

- CONTACT INFORMATION** Department of Mathematics yuchenl[at]northwestern.edu
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2033 Sheridan Rd
Evanston, IL, USA 60208
- RESEARCH INTERESTS** I am interested in algebraic geometry and its connections to complex geometry and commutative algebra, specifically Fano varieties, K-stability, moduli spaces, and singularities.
- EMPLOYMENT**
- Northwestern University**
Associate Professor, September 2024 — present
Assistant Professor, July 2021 — August 2024
- Princeton University**
Visiting Assistant Professor, September 2020 — June 2021
- Yale University**
Gibbs Assistant Professor, August 2017 — August 2020
- Mathematical Sciences Research Institute**
Della Pietra Endowed Postdoctoral Fellow, January — May 2019
- EDUCATION**
- Princeton University**
Ph.D. in Mathematics, June 2017
• Thesis advisor: Professor János Kollár
- Peking University**
M.A. in Mathematics, July 2013
• Thesis advisor: Professor Gang Tian
B.A. in Mathematics, July 2011
- AWARDS**
- NSF Conference Grant DMS-2348566 (co-PI), 2024.
 - Frontiers of Science Award, International Congress of Basic Science, 2023.
 - NSF CAREER Grant DMS-2237139, 2023–2028.
 - Alfred P. Sloan Research Fellowship, 2022–2024.
 - NSF Grant DMS-2148266 (formerly DMS-2001317), 2020–2023.
 - AMS-Simons Travel Grant, 2019–2020.
- PUBLISHED AND ACCEPTED PAPERS**
1. *A note on Kollár valuations* (joint with Chenyang Xu) (2024). *Sci. China Math.*, special issue in memory of Professor Gang Xiao, to appear. [arXiv:2406.00228](https://arxiv.org/abs/2406.00228).
 2. *On K-moduli of quartic threefolds* (joint with Hamid Abban, Ivan Cheltsov, Alexander Kasprzyk, and Andrea Petracci) (2023). *Algebr. Geom.*, to appear. [arXiv:2210.14781](https://arxiv.org/abs/2210.14781).
 3. *Infinitely many families of Sasaki-Einstein metrics on spheres* (joint with Taro Sano and Luca Tasin) (2022). *J. Differential Geom.*, to appear. [arXiv:2203.08468](https://arxiv.org/abs/2203.08468).

4. *Wall crossing for K -moduli spaces of plane curves* (joint with Kenneth Ascher and Kristin DeVleming). Proc. Lond. Math. Soc. (3) 128 (2024), no. 6, Paper No. 12615, 113 pp.
5. *Convexity of multiplicities of filtrations on local rings* (joint with Harold Blum and Lu Qi). Compos. Math. 160 (2024), no. 4, 878-914.
6. *ACC for local volumes and boundedness of singularities* (joint with Jingjun Han and Lu Qi). J. Algebraic Geom. 32 (2023), no. 3, 519-583.
7. *On the Cheltsov–Rubinstein conjecture* (joint with Kento Fujita, Hendrik Süß, Kewei Zhang, and Ziquan Zhuang). Birational geometry, Kähler–Einstein metrics and degenerations, 865-883. Springer Proc. Math. Stat., 409, Springer, Cham, 2023.
8. *K -stability and birational models of moduli of quartic $K3$ surfaces* (joint with Kenneth Ascher and Kristin DeVleming). Invent. Math. 232 (2023), no. 2, 471-552.
9. *K -moduli of curves on a quadric surface and $K3$ surfaces* (joint with Kenneth Ascher and Kristin DeVleming). J. Inst. Math. Jussieu 22 (2023), no. 3, 1251-1291.
10. *The existence of the Kähler-Ricci soliton degeneration* (joint with Harold Blum, Chenyang Xu, and Ziquan Zhuang). Forum Math. Pi 11 (2023), Paper No. e9, 28 pp.
11. *K -stability of Fano threefolds of rank 2 and degree 14 as double covers*. Math. Z. 303 (2023), no. 2, Paper No. 38, 9 pp.
12. *Optimal destabilization of K -unstable Fano varieties via stability thresholds* (joint with Harold Blum and Chuyu Zhou). Geom. Topol. 26 (2022), no. 6, 2507-2564.
13. *Openness of K -semistability for Fano varieties* (joint with Harold Blum and Chenyang Xu). Duke Math. J. 171 (2022), no. 13, 2753-2797.
14. *Finite generation for valuations computing stability thresholds and applications to K -stability* (joint with Chenyang Xu and Ziquan Zhuang). Ann. of Math. (2) 196 (2022), no. 2, 507-566.
15. *On K -stability of some del Pezzo surfaces of Fano index 2* (joint with Andrea Petracci). Bull. Lond. Math. Soc. 54 (2022), no. 2, 517-525.
16. *K -stability of cubic fourfolds*. J. Reine Angew. Math. 786 (2022), 55-77.
17. *On the sharpness of Tian’s criterion for K -stability* (joint with Ziquan Zhuang). Nagoya Math. J. 245 (2022), 41-73.
18. *Openness of uniform K -stability in families of \mathbb{Q} -Fano varieties* (joint with Harold Blum). Ann. Sci. Éc. Norm. Supér. (4) 55 (2022), no. 1, 1-41.
19. *Equivariant K -stability under finite group action* (joint with Ziwen Zhu). Internat. J. Math. 33 (2022), no. 1, Paper No. 2250007, 21 pp.
20. *On properness of K -moduli spaces and optimal degenerations of Fano varieties* (joint with Harold Blum, Daniel Halpern-Leistner, and Chenyang Xu). Selecta Math. (N.S.) 27 (2021), no. 4, Paper No. 73, 39 pp.

21. *The normalized volume of a singularity is lower semicontinuous* (joint with Harold Blum). J. Eur. Math. Soc. (JEMS) 23 (2021), no. 4, 1225-1256.
22. *Birational superrigidity and K-stability of singular Fano complete intersections* (joint with Ziquan Zhuang). Int. Math. Res. Not. IMRN 2021, no. 1, 382-401.
23. *A guided tour to normalized volume* (joint with Chi Li and Chenyang Xu). Geometric analysis—in honor of Gang Tian’s 60th birthday, 167-219, Progr. Math., 333, Birkhäuser/Springer, Cham, 2020.
24. *K-stability of cubic threefolds* (joint with Chenyang Xu). Duke Math. J. 168 (2019), no. 11, 2029-2073.
25. *Kähler-Einstein metrics and volume minimization* (joint with Chi Li). Adv. Math. 341 (2019), 440-492.
26. *Hyperbolicity of cyclic covers and complements*. Trans. Amer. Math. Soc. 370 (2018), no. 8, 5341-5357.
27. *Characterization of projective spaces by Seshadri constants* (joint with Ziquan Zhuang). Math. Z. 289 (2018), no. 1-2, 25-38.
28. *Construction of hyperbolic Horikawa surfaces*. Ann. Inst. Fourier (Grenoble) 68 (2018), no. 2, 541-561.
29. *The volume of singular Kähler-Einstein Fano varieties*. Compos. Math. 154 (2018), no. 6, 1131-1158.

PREPRINTS

1. *K-semistability of log Fano cone singularities* (joint with Yueqiao Wu) (2024). Preprint. arXiv:2408.05189.
2. *Good moduli spaces for boundary polarized Calabi-Yau surface pairs* (joint with Harold Blum) (2024). Submitted. arXiv:2407.00850.
3. *Wall-crossing for K-moduli spaces of certain families of weighted projective hypersurfaces* (joint with In-Kyun Kim and Chengxi Wang) (2024). Submitted. arXiv:2406.07907.
4. *K-stability of special Gushel-Mukai manifolds* (joint with Linsheng Wang) (2024). Submitted. arXiv:2405.10797.
5. *K-moduli of Fano threefolds and genus four curves* (joint with Junyan Zhao) (2024). Submitted. arXiv:2403.16747.
6. *Moduli of boundary polarized Calabi-Yau pairs* (joint with Kenneth Ascher, Dori Bejleri, Harold Blum, Kristin DeVleming, Giovanni Inchiostro, and Xiaowei Wang) (2023). Submitted. arXiv:2307.06522.
7. *On the boundedness of singularities via normalized volume* (joint with Joaquín Moraga and Hendrik Süß) (2023). Submitted. arXiv:2205.12326v4.

INVITED TALKS

- EPIGA Conference, Paris, France Jun/2024
- Yonsei University AG Seminar, Online May/2024
- K-stability and moment maps, Isaac Newton Institute, Cambridge, UK May/2024

- Zhejiang University AG Seminar, Online Apr/2024
- Oberwolfach Workshop: K-Stability, Birational Geometry and Mirror Symmetry, Oberwolfach, Germany Mar/2024
- Workshop on Moduli, K-trivial Varieties, and Related Topics, IBS-CCG, Daejeon, South Korea Feb/2024
- Boston College AG Seminar, Chestnut Hill, MA, USA Nov/2023
- Online Nottingham AG Seminar, Online Oct/2023
- UIC AG Seminar, Chicago, IL, USA Sep/2023
- 5th Kyoto+ Workshop on Arithmetic and Geometry, Nanjing University, Online Aug/2023
- International Congress of Basic Science, BIMSA, Beijing, China Jul/2023
- International Summer School of Algebraic Geometry, SCMS, Fudan University, Shanghai, China Jul/2023
- FRG Special Month in Ann Arbor, University of Michigan, Ann Arbor, MI, USA May/2023
- Stony Brook University AG Seminar, Stony Brook, NY, USA Apr/2023
- Around Complex Geometry, UIC, Chicago, IL, USA Apr/2023
- Workshop on “Developments in moduli problems”, AIM, San Jose, CA, USA Feb/2023
- Purdue University AG seminar, West Lafayette, IN, USA Nov/2022
- Birational Geometry and K-stability of Fano Varieties, ICMS, Edinburgh, UK Nov/2022
- Seminar of Algebraic Geometry in East Asia, Online Sep/2022
- Geometric Analysis Annual Conference, Online Sep/2022
- Simons Conferences – Stability and Moduli, Simons Center for Geometry and Physics, Stony Brook, NY, USA Aug/2022
- Derived Categories, Moduli Spaces, and Hyperkähler Varieties, University of Michigan, Ann Arbor, MI, USA Aug/2022
- Summer short course, CIM, Nankai University, Online Jul/2022
- Oberwolfach Workshop: Algebraic Geometry: Moduli Spaces, Birational Geometry and Derived Aspects, Oberwolfach, Germany Jul/2022
- JAMI 2022: Higher Dimensional Algebraic Geometry, in honor of Prof. Shokurov’s 70th Birthday, Johns Hopkins University, Baltimore, MD, USA May/2022
- University of Michigan AG Seminar, Ann Arbor, MI, USA Apr/2022
- Departmental Colloquium, University of Michigan, Ann Arbor, MI, USA Apr/2022
- Smith Colloquium, University of Kansas, Online Mar/2022
- Beihang University Differential Geometry Seminar, Online Mar/2022
- Workshop on birational geometry, HSE, Online Mar/2022
- Princeton University AG Seminar, Princeton, NJ, USA Feb/2022
- Sichuan University Algebra and Number Theory Forum, Online Dec/2021
- IBS-CCG AG Seminar, Online Oct/2021
- SCMS-Fudan AG Seminar, Online Sep/2021
- Kansas Geometry Day, University of Kansas, Online Aug/2021

- Special Month on Singularities & K-Stability, University of Utah, Online May/2021
- Westlake Mathematics Seminar, Westlake University, Online Mar/2021
- Minicourse on K-stability, Zhejiang University, Online Dec/2020
- Columbia University AG Seminar, Online Dec/2020
- Special Session on Algebraic singularities in arbitrary characteristic, AMS Sectional Meeting, Online Oct/2020
- Simons Conferences – K-stability, Online Sep/2020
- Harvard/MIT AG Seminar, Online Sep/2020
- Princeton University AG Seminar, Online Sep/2020
- Zoom Algebraic Geometry Seminar, Online Aug/2020
- BICMR Geometric Analysis Seminar, Online Jul/2020
- SCMS-Fudan AG Seminar, Online Jun/2020
- Summer School on Fano Varieties, Xiamen University, Online Jun/2020
- Stanford University AG Seminar, Online May/2020
- Nanjing University Differential Geometry Seminar, Online May/2020
- University of Connecticut Algebra Seminar, Storrs, CT, USA Mar/2020
- Thematic Seminar, University of California, Berkeley, CA, USA Jan/2020
- Workshop on “K-stability and related topics”, AIM, San Jose, CA, USA Jan/2020
- Joint AG and Max Dehn Seminar, University of Utah, Salt Lake City, UT, USA Jan/2020
- Departmental Colloquium, University of Utah, Salt Lake City, UT, USA Jan/2020
- Northwestern University AG Seminar, Evanston, IL, USA Dec/2019
- Special Colloquium, University of Minnesota, Minneapolis, MN, USA Nov/2019
- University of Utah AG Seminar, Salt Lake City, UT, USA Oct/2019
- Lecture Series in Algebraic Geometry, Morningside Center of Mathematics, Beijing, China Aug/2019
- Workshop on Algebraic Geometry, Fudan University, Shanghai, China Jul/2019
- SCMS AG Seminar, Fudan University, Shanghai, China Jul/2019
- National Algebraic Geometry Conference, East China Normal University, Shanghai, China Jul/2019
- University of Colorado Boulder FRAGMENT Seminar, Boulder, CO, USA Apr/2019
- Birational Geometry, Kähler-Einstein Metrics and Degenerations, Higher School of Economics, Moscow, Russia Apr/2019
- Lectures on Local and Global K-stability Theory, MSRI, Berkeley, CA, USA Apr/2019
- Birational Geometry and Moduli Spaces Seminar, MSRI, Berkeley, CA, USA Feb/2019
- University of Maryland Algebra and Number Theory Seminar, College Park, MD, USA Dec/2018

- Workshop on Algebraic Geometry, Princeton, NJ, USA Dec/2018
- Connection for Algebraic Geometers, Shanghai Center of Mathematical Sciences, Shanghai, China Nov/2018
- University of Illinois at Chicago AG Seminar, Chicago, IL, USA Oct/2018
- UMass Amherst Valley Geometry Seminar, Amherst, MA, USA Oct/2018
- Algebraic Surfaces and Related Topics, Xiamen University, Xiamen, China Sep/2018
- Yale University Algebraic and Tropical Geometry Seminar, New Haven, CT, USA Sep/2018
- BICMR AG Seminar, Beijing, China Jul/2018
- Workshop on Degenerations of Calabi-Yau Manifolds, Paris, France May/2018
- University of Utah AG Seminar, Salt Lake City, UT, USA Apr/2018
- Special Session on Algebraic Geometry and its Connections, AMS Sectional Meeting, Portland, OR, USA Apr/2018
- Northeastern University Geometry, Physics, and Representation Theory Seminar, Boston, MA, USA Mar/2018
- Northwestern University AG Seminar, Evanston, IL, USA Feb/2018
- Young Mathematician Forum, Peking University, Beijing, China Dec/2017
- Johns Hopkins University AG Seminar, Baltimore, MD, USA Dec/2017
- Princeton University AG Seminar, Princeton, NJ, USA Oct/2017
- Harvard/MIT AG Seminar, Cambridge, MA, USA Oct/2017
- Brown University AG Seminar, Providence, RI, USA Sep/2017
- Colloquium at Rutgers University, Newark, NJ, USA Sep/2017
- Yale University Algebraic and Tropical Geometry Seminar, New Haven, CT, USA Sep/2017
- Stanford University AG Seminar, Stanford, CA, USA May/2017
- Stony Brook University Geometry/Topology Seminar, Stony Brook, NY, USA Mar/2017
- Yale University Algebraic and Tropical Geometry Seminar, New Haven, CT, USA Feb/2017
- Geometry & Topology at Princeton, Princeton, NJ, USA Feb/2017
- Stony Brook University AG Seminar, Stony Brook, NY, USA Jan/2017
- Purdue University AG Seminar, West Lafayette, IN, USA Nov/2016
- University of Michigan AG Seminar, Ann Arbor, MI, USA Oct/2016
- Algebraic Geometry: Old and New, Clay Research Conference and Workshops, Oxford, UK Sep/2016
- Université d'Aix-Marseille Complex Geometry Seminar, Marseille, France Sep/2016
- Institut Fourier AG Seminar, Grenoble, France Sep/2016
- Fudan University AG Seminar, Shanghai, China Jun/2016
- Beijing Algebraic Geometry Colloquium, Beijing, China Jun/2016
- Tokyo-Princeton Algebraic Geometry Conference, Princeton University, Princeton, NJ, USA May/2016

- TEACHING EXPERIENCE
- Algebraic Geometry (MATH 483-1), Northwestern University W/2024
 - Abstract Algebra (MATH 330-2), Northwestern University W/2024
 - Abstract Algebra (MATH 330-1), Northwestern University F/2023
 - Abstract Algebra (MATH 330-2), Northwestern University W/2023
 - Abstract Algebra (MATH 330-1), Northwestern University F/2022
 - Multivariable Differential Calculus for Engineering (MATH 228-1), Northwestern University F/2022
 - Algebraic Geometry (MATH 483-2), Northwestern University W/2022
 - Commutative Algebra (MATH 477-0), Northwestern University F/2021
 - Abstract Algebra (MATH 330-1), Northwestern University F/2021
 - Introduction to Riemann Surfaces (MAT 531), Princeton University S/2021
 - Linear Algebra with Applications (MAT 202), Princeton University F/2020
 - Discrete Mathematics (MATH 244), Yale University S/2020
 - Linear Algebra with Applications (MATH 222), Yale University F/2019
 - Foundations of Algebraic Geometry (MATH 619), Yale University F/2019
 - Reading Course on Algebraic Surfaces, Yale University F/2018
 - Reflection Groups (MATH 235), Yale University S/2018
 - Linear Algebra with Applications (MATH 222), Yale University F/2017
 - Foundations of Algebraic Geometry (MATH 619), Yale University F/2017
 - Linear Algebra with Applications (MAT 202), Princeton University S/2016
- PH.D. STUDENTS
- Colin Fan, present (co-advised with Gábor Székelyhidi)
 - Daniel Mallory, present
 - Junyan Zhao (UIC), Ph.D. 2024 (co-advised with Izzet Coskun and Lawrence Ein)
- POSTDOCS
- Fernando Figueroa, 2024 – present
 - Jihao Liu, 2021 – 2024
 - Kai Huang, 2022 – 2023
- SERVICES
- Committee member of:
- Tenure-Line Hiring Committee, 2022–2023, 2023–2024.
 - Postdoc Hiring Committee, 2021–2022.
- Co-organizer of:
- Asymptotics in Complex Geometry, a conference in memory of Steve Zelditch, Northwestern University, 2024.
 - Algebraic geometry and cohomology in mixed characteristic, Northwestern University, 2023.
 - AIM Workshop: Developments in moduli problems, 2023.
 - Northwestern-UIC Complex Geometry Seminar, 2022–present.
 - Northwestern Algebraic Geometry Seminar, 2021–present.
 - AIM Workshop: Moduli problems beyond geometric invariant theory, 2021
 - Online Algebraic Geometry Seminar, 2020.

- BATMOBYLE (Bi-annual Algebraic and Tropical Meetings of Brown and Yale), 2017–2021.
- Yale Algebraic and Tropical Geometry Seminar, 2017–2020.
- Princeton Algebraic Geometry Seminar, 2016–2017.

Mentor of:

- AGNES Summer School on Higher Dimensional Moduli, Brown University, 2022.

Referee for: Advances in Mathematics, Annales de l’Institut Fourier, Annals of Mathematics, Bulletin of the London Mathematical Society, Compositio Mathematica, Duke Mathematical Journal, Forum of Mathematics Sigma, Geometric and Functional Analysis, Geometry & Topology, International Journal of Mathematics, International Mathematics Research Notices, Journal of Algebraic Geometry, Journal of the American Mathematical Society, Journal of Differential Geometry, Journal of the London Mathematical Society, Journal für die reine und angewandte Mathematik (Crelle’s Journal), Mathematical Proceedings of the Cambridge Philosophical Society, Mathematische Zeitschrift, Moduli, Nagoya Mathematical Journal, Peking Mathematical Journal, Proceedings of the American Mathematical Society, Proceedings of the London Mathematical Society, Pure and Applied Mathematics Quarterly, Transactions of the American Mathematical Society.

Reviewer for: Mathematical Reviews, zbMATH Open

LANGUAGES

Chinese (native), English (fluent)