

# YUCHEN LIU

- CONTACT INFORMATION** Department of Mathematics      yuchenl[at]northwestern.edu  
Northwestern University      faculty.wcas.northwestern.edu/yuchenl/  
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**  
Assistant Professor, July 2021 — present
- 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**
- 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. *ACC for local volumes and boundedness of singularities* (joint with Jingjun Han and Lu Qi). *J. Algebraic Geom.* 32 (2023), no. 3, 519–583.
  2. *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.
  3. *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.

4. *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.
5. *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.
6. *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.
7. *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.
8. *Openness of K-semistability for Fano varieties* (joint with Harold Blum and Chenyang Xu). *Duke Math. J.* 171 (2022), no. 13, 2753-2797.
9. *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.
10. *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.
11. *K-stability of cubic fourfolds*. *J. Reine Angew. Math.* 786 (2022), 55-77.
12. *On the sharpness of Tian's criterion for K-stability* (joint with Ziquan Zhuang). *Nagoya Math. J.* 245 (2022), 41-73.
13. *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.
14. *Equivariant K-stability under finite group action* (joint with Ziwen Zhu). *Internat. J. Math.* 33 (2022), no. 1, Paper No. 2250007, 21 pp.
15. *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.
16. *The normalized volume of a singularity is lower semicontinuous* (joint with Harold Blum). *J. Eur. Math. Soc. (JEMS)* 23 (2021), no. 4, 1225-1256.
17. *Birational superrigidity and K-stability of singular Fano complete intersections* (joint with Ziquan Zhuang). *Int. Math. Res. Not. IMRN* 2021, no. 1, 382-401.
18. *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.
19. *K-stability of cubic threefolds* (joint with Chenyang Xu). *Duke Math. J.* 168 (2019), no. 11, 2029-2073.
20. *Kähler-Einstein metrics and volume minimization* (joint with Chi Li). *Adv. Math.* 341 (2019), 440-492.
21. *Hyperbolicity of cyclic covers and complements*. *Trans. Amer. Math. Soc.* 370 (2018), no. 8, 5341-5357.

22. *Characterization of projective spaces by Seshadri constants* (joint with Ziquan Zhuang). *Math. Z.* 289 (2018), no. 1-2, 25-38.
23. *Construction of hyperbolic Horikawa surfaces*. *Ann. Inst. Fourier (Grenoble)* 68 (2018), no. 2, 541-561.
24. *The volume of singular Kähler-Einstein Fano varieties*. *Compos. Math.* 154 (2018), no. 6, 1131-1158.

PREPRINTS

1. *Moduli of boundary polarized Calabi–Yau pairs* (joint with Kenneth Ascher, Dori Bejleri, Harold Blum, Kristin DeVleming, Giovanni Inchiostro, and Xiaowei Wang) (2023). Preprint. [arXiv:2307.06522](https://arxiv.org/abs/2307.06522).
2. *On  $K$ -moduli of quartic threefolds* (joint with Hamid Abban, Ivan Cheltsov, Alexander Kasprzyk, and Andrea Petracci) (2023). Submitted. [arXiv:2210.14781v2](https://arxiv.org/abs/2210.14781v2).
3. *On the boundedness of singularities via normalized volume* (joint with Joaquín Moraga and Hendrik Süß) (2023). Submitted. [arXiv:2205.12326v4](https://arxiv.org/abs/2205.12326v4).
4. *Convexity of multiplicities of filtrations on local rings* (joint with Harold Blum and Lu Qi) (2022). Submitted. [arXiv:2208.04902](https://arxiv.org/abs/2208.04902).
5. *Infinitely many families of Sasaki-Einstein metrics on spheres* (joint with Taro Sano and Luca Tasin) (2022). Submitted. [arXiv:2203.08468](https://arxiv.org/abs/2203.08468).
6. *Wall crossing for  $K$ -moduli spaces of plane curves* (joint with Kenneth Ascher and Kristin DeVleming) (2019). Submitted. [arXiv:1909.04576](https://arxiv.org/abs/1909.04576).

INVITED TALKS

- 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, Jul/2019

- China
- 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

- 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

- Daniel Mallory, present
- Junyan Zhao (UIC), present (co-advised with Izzet Coskun and Lawrence Ein)

POSTDOCS

- Jihao Liu, 2021 – present
- Kai Huang, 2022 – 2023

SERVICES

Committee member of:

- Tenure-Line Hiring Committee, 2022–2023.
- Postdoc Hiring Committee, 2021–2022.

Co-organizer of:

- Algebraic geometry and cohomology in mixed characteristic, 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*, *Mathematical Proceedings of the Cambridge Philosophical Society*, *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*, *Zentralblatt MATH*

LANGUAGES

Chinese (native), English (fluent)