Max Hallgren

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Areas of specialization

Ricci Flow, Geometric Analysis

Education

2016-2022 **PhD in Mathematics**, Cornell University:
–M.S. received in 2018
–Advisor: Xiaodong Cao
–Research Area: Ricci Flow, Geometric Analysis

2017 **Visiting Student**, Fields Institute
–Thematic Program on Geometric Analysis, Fall 2017 semester

2012-2016 **B.A. in Mathematics**, Cornell University

Employment

2022- **NSF Mathematical Sciences Postdoctoral Research Fellow/Hill Assistant Professor**, Rutgers University

Grants, honors & awards

2022 **Mathematical Sciences Postdoctoral Research Fellowship**, Fine Structure of Singularity Formation in Four-Dimensional Ricci Flow, National Science Foundation

2019 **Hutchinson Fellowship**, Cornell University
–Awarded for excellence in research, provides one semester of teaching relief

2017 **Eleanor Norton York Award**, Cornell University

2016 **Summa cum Laude**, Cornell University
Harry S. Kievel Prize in Mathematics, Cornell University

Publications & talks

Papers and Preprints

Dates on the left denote the year uploaded to arxiv.

2025 **Structure Theory of Parabolic Nodal and Singular Sets,** with R. Koirala and Z. Ma, https://arxiv.org/abs/2511.11570
An ϵ-Regularity Theorem for Non-Collapsed Ricci Flow, with H. Fluck, https://arxiv.org/abs/2509.14154
Remarks on Singular Käher-Einstein Metrics, with G. Székelyhidi, https://arxiv.org/abs/2505.01943
Non-collapsed finite time singularities of the Ricci flow on compact Kähler surfaces are of Type I with R. Conlon, Z. Ma, https://arxiv.org/abs/2502.19804
On Kähler-Einstein Currents, with Y. Chen, S. Chiu, G. Székelyhidi, T. Tô, F. Tong, https://arxiv.org/abs/2502.09825

2023 **Kähler-Ricci Tangent Flows are Infinitesimally Algebraic,** https://arxiv.org/abs/2312.06577
Geometric regularity of blow-up limits of the Kähler-Ricci flow, with W. Jian, J. Song, and G. Tian, *Geom. Funct. Anal.* 34 no.6 (2024)

2022 **Tangent Flows of Kähler Metric Flows,** with W. Jian, *J. für die Reine und Angew. Math* (2023)
Canonical Surgeries in Rotationally Invariant Ricci Flow, with T. Buttsworth and Y. Zhang *Trans. Amer. Math. Soc.* 377 no. 11 (2024).

2021 **Ricci Flow with Ricci Curvature and Volume Bounded Below,** *Mathematische Annalen* 388 no. 2 (2024)

2020 **The Entropy of Ricci Flows with Type-I Scalar Curvature Bounds,** *Advances in Mathematics* 418, (2023)

2019 **Local Stability of Einstein Metrics Under Ricci Iteration,** With T. Buttsworth *Journal of Functional Analysis* 280, No. 2 (2021)

2018 **Nonexistence of Noncompact Type-I Ancient Three-Dimensional κ-Solutions of Ricci Flow with Positive Curvature,** *Communications in Contemporary Mathematics* 21, No. 06, (2019)

2017 **A Differential Harnack Inequality for the Newell-Whitehead-Segel Equation,** With D. Booth, J. Burkart , X. Cao, Z. Munro, J. Snyder, T. Stone *Anal. Theory Appl.*, 35 (2019), pp. 192-204.

Talks

2025 **Finite-Time Singularities of the Ricci Flow on Kähler Surfaces** Lehigh University Geometry Seminar (Spring 2025)
Finite-Time Singularities of the Ricci Flow on Kähler Surfaces Cornell University Analysis Seminar (Spring 2025)
Finite-Time Singularities of the Ricci Flow on Kähler Surfaces BICMR Online Seminar on Geometric Analysis (Spring 2025)
Finite-Time Singularities of the Ricci Flow on Kähler Surfaces ITS Workshop on the Analytic

MMP (Spring 2025)
Finite-Time Singularities of the Ricci Flow on Kähler Surfaces Johns Hopkins University Geometric Analysis Seminar (Spring 2025)
Finite-Time Singularities of the Ricci Flow on Kähler Surfaces Columbia University Informal Complex Geometry and PDE Seminar (Spring 2025)

2024 **Tangent cones of Kähler-Ricci flow singularity models** Indian Institute of Science Geometry and Topology Seminar (Fall 2024)
Tangent cones of Kähler-Ricci flow singularity models Stony Brook Geometry/Topology Seminar (Fall 2024)
Tangent cones of Kähler-Ricci flow singularity models University of Toronto Geometry and Topology Seminar (Fall 2024)
Tangent cones of Kähler-Ricci flow singularity models "Current Trends in Geometric Flows" Workshop at CRM (Summer 2024)
Tangent cones of Kähler-Ricci flow singularity models Institute for Advanced Study in Mathematics, Zhejiang University (Spring 2024)
Tangent cones of Kähler-Ricci flow singularity models UC Berkeley Differential Geometry Seminar (Spring 2024)
Tangent cones of Kähler-Ricci flow singularity models Northwestern University Informal Geometric Analysis Seminar (Spring 2024)
Tangent cones of Kähler-Ricci flow singularity models NYU Geometric Analysis and Topology Seminar (Spring 2024)
Tangent cones of Kähler-Ricci flow singularity models Columbia University Informal Complex Geometry and PDE Seminar (Spring 2024)

2023 **Geometric Regularity of Singularity Models of the Kähler-Ricci Flow** Princeton Geometric Analysis Seminar (Fall 2023)
Geometric Regularity of Singularity Models of the Kähler-Ricci Flow CUHK Geometric Analysis Seminar (Fall 2023)
Geometric Regularity of Singularity Models of the Kähler-Ricci Flow PDE and Geometric Analysis Seminar, University of Connecticut (Fall 2023)
Tangent Flows of Kähler Metric Flows Geometric Flows and Applications, ICMS (Summer 2023)
Tangent Flows of Kähler Metric Flows Workshop on Ricci Flow, UC San Diego (Spring 2023)
Tangent Flows of Kähler Metric Flows Ricci Flow and Related Topics, University of Warwick (Spring 2023)
Tangent Flows of Kähler Metric Flows Rutgers Geometric Analysis Seminar (Spring 2023)

2022 **Nonsmooth Limits of Kähler-Ricci Flows** Rutgers-Newark Colloquium (Fall 2022)
Tangent Flows of Kähler Metric Flows Yale Geometric Analysis & Applications Seminar (Spring 2022, online)
The Tensor Maximum Principle Austrilian Geometric PDE Seminar (Spring 2022, online)
Ricci Flow with a Lower Bound on Ricci Curvature and Volume University of Iowa Differential Geometry Seminar (Spring 2022, online)
Ricci Flow with a Lower Bound on Ricci Curvature and Volume GeoTop Seminar at the University of Copenhagen (Winter 2022, online)

2021 **Ricci Flow with a Lower Bound on Ricci Curvature and Volume** Online seminar "Metric Measure Spaces and Convergence" (Fall 2021, online)
Ricci Flow with a Lower Bound on Ricci Curvature and Volume Beijing International Center for Mathematical Research (Spring 2021, online)
Ricci Flow with a Lower Bound on Ricci Curvature and Volume City University of New York Geometric Analysis Seminar (Spring 2021, online)

2020 **Singular Ricci Flows** Cornell Geometric Analysis Seminar (Fall 2020, online)
Entropy convergence of Ricci flows with a Type-I scalar curvature bound University of Wisconson-Madison Geometry and Topology Seminar (Fall 2020)
Almost Splitting Theorem University of California at San Diego Cheeger-Colding Seminar (3-part talk) (Summer 2020, online)
Quantitative Stratification University of California at San Diego Cheeger-Colding Seminar (2-part talk) (Summer 2020, online)

2019 **Entropy convergence of Ricci flows with a Type-I scalar curvature bound.** Rutgers Complex Analysis and Geometry Seminar (Fall 2019)
Entropy convergence of Ricci flows with a Type-I scalar curvature bound. Cornell Analysis Seminar (Fall 2019)

2018 **Backward Uniqueness for Parabolic Equations**. Bonn University Summer School: Unique Continuation and Inverse Problems (Fall 2018)

2016 **Neckpinch Singularities in Ricci Flow.** Cornell Geometric Analysis Seminar (2-part talk) (Fall 2016)
Curvature, Topology, and Pinched Spheres. Cornell Undergraduate Math Club (Spring 2016)

Teaching

2023 **Lecturer**, Rutgers University

- Calculus 2 for the Mathematical and Physical Sciences (Fall 2025)
- Introductory Linear Algebra (Math 250) (Fall 2025)
- Linear Algebra (Math 350) (Fall 2024)
- Calculus 1 for the Mathematical and Physical Sciences (Fall 2023)

2017-2022 **Teaching Assistant**, Cornell University

- Differential Geometry (Spring 2022)
- Applied Complex Analysis (Fall 2021)
- Graduate Differentiable Manifolds (Fall 2020)
- Graduate Applied Functional Analysis (Spring 2020)

- Partial Differential Equations (Spring 2019)
- Theoretical Linear Algebra and Calculus (Fall 2018)
- Graduate Partial Differential Equations (Spring 2018, Spring 2020)
- Calculus for the Life Sciences (Spring 2017)

2019 **Instructor**, Cornell University

- Calculus I (Fall 2019)

2014-2015 **Tutor**, Cornell University Math Support Center (August 2014-December 2015)

Service

2020 **Mentor,** Cornell University Directed Reading Program (Spring 2021-Spring 2022)
2017 **Co-organizer,** Cornell Olivetti Seminar (Spring 2017)
2016 **Mentor,** Cornell Research Experience for Undergraduates in "Nonlinear Heat Equations" (Summer 2016)