Ayush Khaitan

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Research Interests

Automated reasoning and machine learning, Combinatorics, Differential Geometry.

Employment

Rutgers University, New Brunswick
Hill Assistant Professor *2023–Present*

Education

Penn State University **University Park, PA**
Ph.D., Mathematics *2017–2023*
Advisor: Jeffrey Case

Birla Institute of Technology and Science **Pilani, India**
Bachelor of Engineering *2011–2015*

SJI International **Singapore**
International Baccalaureate, Keppel Magus scholar from India *2008–2010*

Publications

2023: **Ambient metric for manifolds with density and the Ricci flow**, Advances in Mathematics (2026), Article reference: YAIMA_110787. Journal link.

2022: **The weighted ambient metric** with Jeffrey S. Case, SIGMA **18** (2022), 086, 21 pages. Journal Link

2022: **GJMS operators of smooth metric measure spaces** (accepted at Journal of Geometric Analysis). arXiv link

2022: **Weighted renormalized volume coefficients**(accepted at Differential Geometry and its Applications). arXiv link

Preprints

2025: **An LLM-CAS framework for proving asymptotic inequalities** with Vijay Ganesh (Submitted). arXiv link. Our tool was recently highlighted by Terence Tao.

2025: **Elementary symmetric polynomials under the fixed point measure** with Bhargav Narayanan and Ishan Mata (submitted). arXiv link.

2024: **Computing renormalized curvature integrals on Poincaré-Einstein manifolds** with Jeffrey Case, Yueh-Ju Lin, Aaron Tyrell and Wei Yuan (under consideration at Advances in Mathematics). arXiv link.

Research activities

Co-organizer: JMM Panel on the use of AI tools to aid Mathematics research. Panel website. Joint Mathematics Meetings, 2025 in Seattle

Co-organizer: LLMs in Mathematics research group, Rutgers University. Research group website. 2023–Present

Co-organizer: Complex geometry and Harmonic analysis seminar, Rutgers University. Seminar website. 2024–Present

Co-organizer: Special session on recent developments in geometric analysis, AMS Eastern Sectional Meeting 2024, Howard University, Washington D.C. Meeting website. April, 2024

Co-organizer: AI and Math seminar, Rutgers University. 2024–Present

Teaching

Rutgers

A Lean based Intro to Proofs (Honors course): Rutgers University, one semester

Machine learning and AI tools in Math Research (Graduate course): Rutgers University, one semester

Linear algebra: Rutgers University, one semester

History of Mathematics: Rutgers University, one semester

Calculus for engineers: Rutgers University, one semester

Penn State

Calculus I: Penn State University, Multiple semesters

Calculus II: Penn State University, Multiple semesters

Linear Algebra: Penn State University, One semester

Plane trigonometry: Penn State University, One semester

Invited Talks

2022: Geometry, Topology and Dynamical Systems seminar, University of Texas at Dallas

2022: Geometry Luncheon seminar, Penn State University

2023: Geometric Analysis Seminar, Rutgers University

2023: Nonlinear Anlysis Seminar, Rutgers University

2023: Geometry, Topology and Dynamical Systems seminar, University of Texas at Dallas

2023: Geometry/Topology seminar, Stony Brook University

2024: Colloquium, Rutgers University, Newark

2025: Geometry and Topology seminar, University of Washington, St Louis

2025: Special session on geometric analysis and PDEs, AMS Eastern Sectional Meeting, 2025, Hartford, CT

2025: CUNY Geometric Analysis Seminar, City University of New York, NY

2025: Brown University Geometric Analysis Seminar, Providence, RI

2025: AI and Math seminar, Rutgers University, New Brunswick, NJ

2025: AI Seminar, Simon Fraser University, CA

2025: AI/ML talk, Penn State University, PA

Selected conferences and workshops attended

2016: MSRI Summer School on Tropical Geometry. Berkeley

2019: Geometry festival. Princeton University, Princeton

2023: International Doctoral Summer School in Conformal Geometry. IMAG, Granada

2025: AI for the working Mathematician. ICERM, Providence

2025: AI for Mathematics and Theoretical Computer Science. Simons Institute for the Theory of Computing, Berkeley

2025: Lean workshop, Simons Institute, New York City

2025: Problem-solving Workshop, Computational Geometric Analysis. CUNY, New York City

2025: Mathematical Congress of the Americas. Miami, FL

Awards

2008: Keppel Magus Scholarship ($40,000), IB Diploma in Singapore, one scholar from Calcutta, India

2009: Bronze medal, Singapore Math Olympiad

2017: Distinguished Graduate Fellowship, Penn State University, given to 10 incoming graduate students across all departments

2022: Pritchard Dissertation Fellowship, Penn State University, given to 2 graduating PhD students in the Mathematics department

2024-2026: AIM SQuaRE Grant with Jeffrey Case, Yueh-Ju Lin, Aaron Tyrell and Wei Yuan

2025: AMS Travel grant, Mathematical Congress of the Americas