



# Akash Sudhanshu

5<sup>th</sup> Year student  
Master and Bachelor of Science (Research)  
Mathematics Major  
Indian Institute of Science, Bangalore

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## EDUCATION

- **Indian Institute of Science, Bangalore** 2021 - 2026 (Expected)  
*Master and Bachelor of Science (Research), Mathematics Major* **CGPA: 9.1**

## RESEARCH INTERESTS

Geometry and Topology, Teichmüller Theory, Complex Dynamics, Complex Geometry.

## SELECTED COURSEWORK

Introduction to Complex Dynamics (Ongoing)	Functional Analysis (Ongoing)
Complex Manifolds	Introduction to Differential Manifolds
Riemann Surfaces	Ordinary Differential Equations
Riemannian Geometry	Multivariable Calculus
Introduction to Several Complex Variables	Analysis II: Measure and Integration
Algebraic Topology	Algebra II

## RELEVANT PROJECTS

- **Bachelors and Masters Thesis: Bounded Distortion Conjecture for punctured surfaces** Jan 2025 - Ongoing  
Mentor: **Associate Professor Subhojoy Gupta, IISc**
  - Working on Penner's conjecture concerning the Teichmüller distortion of a combinatorial transformation from (decorated) hyperbolic structures to (decorated) singular-flat structures.
  - Explained the combinatorial transformation rigorously as a composition of two maps with an algorithmic perspective (in Bachelor's thesis).
  - New Results:**
    - Proved the naturality of the transformation with respect to covering maps between punctured surfaces. This lets us extend results for a once-punctured torus to all punctured surfaces with positive genus via the Hurwitz existence problem.
    - Defined the setup for the once-punctured torus using various models of its Teichmüller space and derived the exact expression of the combinatorial transformation in terms of elliptic integrals.
    - Calculated various estimates on its distortion using extremal length estimates and cross ratios. Currently, computationally analyzing the asymptotic behavior of the estimates near the Teichmüller space boundary.
- **Dynamics of Conformal mappings of Quadrilaterals** Nov 2025 - Ongoing  
Mentor: **Associate Professor Subhojoy Gupta, IISc**
  - Investigating the dynamics of iterations of Schwarz Christoffel mappings from discs to Euclidean rectangles and ideal quadrilaterals.
  - **New Result:** Computationally showed that the square is an attracting fixed point for the iterative mapping from the disc to Euclidean rectangles. Currently, studying conformal mappings onto ideal quadrilaterals and working towards proving the above result.
- **Two perspectives on the Weil-Petersson metric** May 2025 - July 2025  
Mentor: **Professor Sumio Yamada, Gakushuin University, Tokyo**
  - Studied the Weil-Petersson metric from both hyperbolic metrics and complex-analytic models of Teichmüller space, and these two models are interrelated. Also studied proofs of the Kählerity in both settings. I particularly liked the complex analytic proof, which used the foliation by leaves corresponding to constant volume and the Frobenius theorem.
- **Foundations of Complex Geometry** May 2024 - July 2024  
Mentor: **Assistant Professor Purvi Gupta, IISc**
  - Studied analytic varieties, sheaf cohomology, de Rham and Dolbeault theorems, vector bundles.
  - As a [side project](#), derived necessary and sufficient conditions for surfaces formed by orbits of a Lie group action on an embedded submanifold to remain embedded.
- **Introduction to Algebraic Topology** Dec 2023  
Mentor: **Professor Siddhartha Gadgil**
  - Covered the 1st chapter of Hatcher's book on Algebraic Topology. Learned about simplicial complexes, covering spaces and deck transformations.

## PRESENTATIONS AND TALKS

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- **Bounded Distortion Conjecture for once-punctured torus** Dec 2025  
Presented my work on the conjecture at the Science Undergraduate Research Conference (SURC) 2025 held at APU, Bengaluru.
- **Hyperbolic LEGO to Teichmüller space** Apr 2025  
Introduced hyperbolic geometry and Fenchel-Nielsen coordinates on Teichmüller space.
- **Algebraic structure of Analytic sets** (Complex Manifolds, Finals) Apr 2025  
Presented how the algebraic structure of  $\mathcal{I}_{A,x}$  and  $\mathcal{O}_{A,x}$  differs at regular and singular points. (Board talk)
- **Abel's Theorem on Riemann surfaces** (Riemann surfaces, Finals) Nov 2024  
Presented the proof of Abel's theorem, which characterizes when a divisor is a principal divisor. (Board talk)
- **Mittag-Leffler Problem** Aug 2024  
Presented Čech's method to solve the Mittag-Leffler problem on Riemann surfaces.

## CONFERENCES ATTENDED

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- **New Trends in Teichmüller Theory, ICTS Bangalore** Feb 2025  
A two-week conference providing an overview of various areas of ongoing research in Teichmüller theory. The topics covered included Weil-Petersson metric (by Sumio Yamada), Higher Teichmüller Theory (by John Parker and Tengren Zhang), Thurston's asymptotic metric (by Ken'ichi Ohshika), Geodesic Currents (by Viveka Erlandsson), among others.
- **Lean for the Curious Mathematicians, ICTS Bangalore** Apr 2025  
A 3-day workshop aiming to introduce mathematicians to the basics of interactive theorem proving. It consisted of a series of talks on major formalization projects and guided labs on formalizing simple mathematical results using Lean.
- **Geometry and Analysis of Minimal Surfaces, ICTS Bangalore** Aug 2025  
A two-week conference with talks by leading experts on topics related to minimal surface theory. I learned about Weierstrass-Enneper parameterization, Higgs bundles and harmonic maps on minimal surfaces.  
**Upcoming:** Topics in Hodge Theory (Jan 2026), Geometric Analysis and PDE (Feb 2026), Geometric Structures and Stability (Feb 2026).

## ACADEMIC ACCOMPLISHMENTS

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- **Alibaba Global Math Competition, Stage 1** 2024  
Qualified Stage 1. This is a global mathematics competition open to all age groups, modeled on the International Mathematics Competition (IMC), attracting participants from top universities across the world.
- **Simon Marais Mathematics Competition (SMMC)** 2023  
Top Quartile (Pair Category). SMMC is an international undergraduate mathematics competition modeled on the Putnam exam, with participants from top universities in Australia, New Zealand, and Asia.
- **Kishore Vaigyanik Protsahan Yojana (KVPY) Fellowship** 2021-Present  
Awarded the KVPY fellowship by the Department of Science and Technology, Government of India. This prestigious scholarship supports students pursuing research careers in basic sciences.

## COMMUNITY SERVICE

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- **Coordinator, Pravega (Undergraduate Fest)** 2023  
Managed and organized online chess tournaments for Pravega, the annual undergraduate science, technology, and cultural festival of the Indian Institute of Science.
- **Notebook Drive** 2022-2023  
A student-run initiative to support and mentor underprivileged children. Responsibilities included visiting local schools and distributing stationery and food supplies.
- **IISc Open Day** 2023-2025  
Presented interactive mathematical exhibits for the general public, like Gambler's Ruin through the Roulette game, Mathematical Puzzles and Reinforcement Learning through matchboxes.

## TECHNICAL SKILLS

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- **Languages/Tools:** Python, MATLAB, Lean, L<sup>A</sup>T<sub>E</sub>X, C++.