

Hongyu Wang

Mathematics Undergraduate Student at Imperial College London

London, UK

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Website

RESEARCH INTERESTS

Algebraic Geometry, Algebraic number theory, Differential Geometry, Mathematical Physics, Formalising Mathematics.

EDUCATION

Imperial College London

London, UK

Bachelor of Science, Mathematics, 1st class in Year 1

Oct 2022 — Jul 2026

Selected Modules:

- Analysis: *Real Analysis and Topology, Complex Analysis, Lebesgue Measure and Integration, Functional Analysis.*
- Algebra: *Linear Algebra, Groups and Rings, Galois Theory, Algebraic Number Theory.*
- Geometry: *Geometry of Curves and Surfaces, Manifolds, Algebraic Topology.*

RESEARCH EXPERIENCE

Noether's Theorem in Lean

Yau Mathematical Sciences Center, Tsinghua University

Beijing, China

Visiting Student

Oct 2024 — Now

Supervised by Prof. William Donovan

- Investigated Noether's theorem in the context of Lean 4, a powerful theorem prover, to formalize the relationship between symmetries and conservation laws in physics.
- Applied advanced mathematical concepts to formalize Noether's theorem, including the theory of Lie groups, Lie algebras, and differential forms, under the guidance of Prof. William Donovan.
- Developed a comprehensive understanding of Noether's theorem and its applications in physics, enhancing problem-solving skills and mathematical expertise through the formalization process.

Classical Mechanics and the Top Problem

Imperial College London

London, UK

Research Assistant

May 2024 — Now

Supervised by Dr. Marco Mendez Guaraco

- Studied "Mathematical Methods of Classical Mechanics" under the supervision of Dr. Marco Mendez Guaraco, acquiring foundational knowledge in Lagrangian and Hamiltonian mechanics using the language of manifolds, and applying these geometrical tools to solve mechanical problems.
- Leveraged advanced mathematical tools such as manifolds and differential geometry to address complex problems in classical mechanics, including the analysis of the top problem.
- Developed a robust understanding of differential geometry and its applications in classical mechanics, under the guidance of Dr. Marco Mendez Guaraco, enhancing problem-solving approaches through a deep geometrical perspective.

Formalising Mathematics

Imperial College London

London, UK

Research Assistant

Apr 2023 — Sep 2023

Supervised by Prof. Kevin Buzzard

- Utilized Lean 4, an advanced theorem prover, to formalize various aspects of group theory, including the basic definitions of groups, group actions, and the orbit-stabilizer theorem, under the supervision of Prof. Kevin Buzzard.
- Currently developing a comprehensive website that serves as an educational platform. This platform aims to teach users how to use Lean 4 to prove mathematical theorems and understand fundamental concepts of group theory.
- The website is designed to make mathematics more accessible and interactive, inspiring users to explore the beauty and logic of group theory through an engaging and user-friendly interface.

The ABC of PDEs

Imperial College London

London, UK

Research Assistant

Apr 2023 — Sep 2023

Supervised by Dr. Hamed Masaoood

- Skillfully applied the spherical method and calculus of variations principles to solve complex wave equations, demonstrating advanced problem-solving abilities and mathematical expertise.
- Under the supervision of Dr. Hamed Masaoood, made valuable contributions to the understanding of wave phenomena through the accurate analysis and interpretation of the obtained solutions.

- Showcased a strong command of mathematical techniques in modelling and solving intricate wave equations, highlighting proficiency in utilizing the spherical method and calculus of variations principles.

PROJECTS

Simple Groups

Imperial College London, Grade: 85%

Group Project, supervised by Prof. Martin Liebeck

May 2024 — Jun 2024

- Collaborated with a research team to investigate the classification of simple groups, analyzing their structure, properties, and applications within group theory.
- Applied Sylow's theorems and group actions to classify simple groups of order less than 100, providing detailed and rigorous proofs.
- Presented a comprehensive analysis on the classification of simple groups, highlighting research findings and insights to students and faculty at Imperial College London.

The Euler Characteristic through Morse Theory

Imperial College London, Grade: 90%

Individual Project

May 2023 — Jun 2023

- Conducted an independent study of fundamental concepts in differential geometry, algebraic topology, and Morse theory, enhancing my theoretical foundation in these areas.
- Initiated a self-guided research project applying Morse Theory to validate the Euler Characteristic for manifolds, demonstrating practical application of advanced mathematical theories.
- Designed and presented a comprehensive poster using \LaTeX , elucidating the aforementioned concepts to students and faculty at Imperial College London, showcasing my ability to communicate complex ideas effectively.

SEMINARS

Geometric Representation Theory

Online

Organiser: Prof. Travis Schedler

Participants

Aug 2023 — Sep 2023

- Conducted in-depth research on Lie Algebra, Knot Theory, and Quantum Groups, focusing on their applications in physics and the exploration of the Yang-Mills Equation.
- Delivered an advanced presentation on Tensor analysis, elucidating its theoretical foundations and practical applications.
- Compiled and organized comprehensive \LaTeX notes for the entire seminar, ensuring clarity and accessibility of complex mathematical concepts.

SUMMER SCHOOLS

Summer School in Geometry

Hefei, China

Student, University of Science and Technology of China

July 2024 — July 2024

- Attended lectures on advanced topics and recent developments in geometry, including Arnold's Cat Map, Ricci Flow, Mean Curvature Flow, and the Barycenter Method.
- Gained a comprehensive understanding of recent advancements in geometry, acquiring insights into cutting-edge research in the field.
- Engaged with leading professors from China in the fields of Geometry and Geometric Analysis, gaining exposure to the research environment and methodologies in China.

Summer Workshop, the Fundamental of Data Science

Online

Student, Stanford University

Jul 2023 — Aug 2023

- Participated in Stanford University's ICME Summer Workshops, acquiring specialized knowledge in machine learning, natural language processing, Python programming, and data visualization.
- Collaborated with a diverse cohort of participants, enhancing professional networks and fostering valuable academic connections.
- Developed expertise in machine learning algorithms, gained advanced insights into natural language processing techniques, and honed programming skills in Python.

SKILLS

- **Programming:** Python, Lean 4, Julia, JavaScript, HTML, C
- **Software:** Git, Microsoft Office Suite, \LaTeX
- **Soft Skills:** Independent Study and Concentration