

YIKAI TENG

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EDUCATION

M.S. Rheinische Friedrich-Wilhelms-Universität Bonn *Expected starting date: October 2021*
Master of Mathematics

B.A. University of Illinois at Urbana-Champaign *August 2018 - May 2021*
Major in Mathematics, Minor in Computer Science
Dean's List: Fall 2018 - Fall 2020 GPA: 3.96

ACADEMIC INTERESTS

I am currently interested in Geometric Topology, in particular, low-dimensional topology, 4-manifolds, and knot theory.

TEACHING EXPERIENCES

Course Aide: Numerical Methods *August 2019 - May 2021*
With Professor Mariana Silva, U of I.

- Teach theory behind numerical methods and help around 400 students in this Python-based course.
- Assist the professor with in-class activities and help develop and revise homework assignments.
- Host weekly office hours, aid around 20 students with their academic problems.
- Help create and revise online notes for numerical methods and build class website.

RESEARCH AND PROJECTS

Higher Symmetries in Geometry and Physics *January 2021 - May 2021*
IGL Project, Under Professor Daniel Berwick Evans, U of I.

- Study the theory behind higher category theory, and in particular, we focus on the **Bi** category of Lie groupoids and bibundles.
- Apply this to Lie group actions on Lie groupoids and prove the equivalence between the category of Lie groupoid actions and the category of central extensions.

Pecan: an automated theorem prover *September 2020 - January 2021*
IGL Project, Under Professor Philipp Hieronymi, U of I.

- Study the theory behind this auto theorem prover, namely a Büchi automaton.
- Study the relation between fractals and automata, and work on the visualization of various fractals given an arbitrary self-similar automaton.
- Presented our result in Joint Mathematical Meeting, 2021.

Polymath REU *June 2020 - October 2020*
Group Research Project, Under Postdoc Cody Stockdale, Clemson University.

- Work on finding a bound for weak-type $(1, 1)$ property for Riesz Transforms.
- Compose a geometric construction for a dimension dependent bound.

Independent Research *January 2020 - August 2020*
Independent Research Project, Under Professor Bruce Reznick, U of I.

- Work on the generalization of Arnold's Cat Map on various dimensions and spaces.
- Focus on the group of measure preserving self maps on arbitrary dimensional tori \mathbb{T}^n , and its relation to the mapping class group, $\mathcal{MCG}(\mathbb{T}^n)$.
- Create Mathematica visualizations of generalized Cat Map.

Visualization of Coupon Collector Problem

January 2019 - September 2019

IGL Project, Under Professor AJ Hildebrand, U of I.

- Study the coupon collector problem and coupon collector randomness test and visualize such problems by Mathematica.
- Simulation accepted by Wolfram demonstration.

EXTRACURRICULA COURSES

Kervaire Invariant Problem and Surgery Theory

January 2021 - Present

Reading Project, Under Professor Jeremiah Heller, U of I.

- Study the concepts and history of Kervaire invariant 1 problem.
- Study basics of surgery theory.

Morse Theory and Floer Homology

August 2020 - December 2020

Reading Project, Under Professor Rui Loja Fernandes, U of I.

- Study Morse Theory in a Algebraic Topology perspective, learning distinctive homologies like Morse Homology and Floer Homology.
- Study basics of Floer Homology and gradually march to the field of Symplectic Geometry.

Gauge Theory and 4-Manifolds

August 2020 - Present

Reading Project, Under Professor Steven Bradlow, U of I.

- Study the topology and geometry of 4-manifolds via the intersection form.
- Study various properties of Principal Bundles, their Ehresmann connections, as well as the curvature of those connections.
- Study multiple applications of Principal Bundles in Physics, including Yang-Mills Theory and Gauge Theory.

Complex Algebraic Curves

January 2020 - January 2021

Reading Project, Under Professor Steven Bradlow, U of I.

- Study the foundation and properties of complex algebraic curves, both algebraically and topologically, including Bézout's Theorem, the degree-genus formula, etc.
- Study complex algebraic curves as Riemann surfaces and related theorems like Abel's Theorem and the Riemann-Roch Theorem.

Complex Analysis in a Geometric Approach

August 2019 - December 2019

Reading Project, Under Professor Richard Laugesen, U of I.

- Apply classical Complex analysis in geometry to study particular metrics like Poincare, Caratheódory, and Kobayashi metric.
- Compare the geometry in complex analysis with classical differential geometry to study the cross sections of the two fields.
- Study harmonic mappings in the complex domain and its application to minimal surface theory.

Modern Theory of Dynamical Systems

August 2019 - December 2019

Reading Project, Under Professor Eduard-Wilhelm Kirr, U of I

- Study advanced modern theory of dynamical systems, particularly the behavior around a hyperbolic fixed point, like the Hadamard-Perron Theorem and the Hartman-Grobman Theorem.
- Conduct the proof of the existence of the Lake of Wada as a group of four.

ADDITIONAL ACTIVITIES

Mathematical Contest for Modelling

February 2020

- Construct a math model to predict where Scottish herring will migrate for the next few decades and provide suggestions for fishing companies in Scotland.

Mechmania

September 2019

- Develop a strategy of a board game to compete with other contestants.

- Compose tests for LinearMappings package for Julia and add support for Quaternion Numbers.
- Compose various tests and make multiple contributions to the DoubleFloat package for Julia.

REFERENCES

Steven Bradlow*Professor*

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