Shize Hao

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FIELDS OF INTEREST

Algebraic Topology, Algebraic Geometry, Number Theory

EDUCATION

Harvard University **Cambridge, MA**

Visiting Undergraduate Student Jan. 2024 – Dec. 2024

- GPA: 4.0/4.0
- Relevant coursework: Algebraic Vector Bundles and Motivic Homotopy Theory (Graduate-level), Recent Advances in Chromatic Homotopy Theory (Graduate-level), Étale Cohomology (Graduate-level), The Arithmetic of Elliptic Curves (Graduate-level), Number Fields, Algebraic Geometry.

Sichuan University **Chengdu, China**

Bachelor of Science in Mathematics Expected graduation: June 2025

- Major GPA: 3.97/4.0; Ranking: 3/124
- Relevant coursework: Algebraic Topology, Homological Algebra (Graduate-level), Differential Geometry and Topology, Differential Manifold, Mathematical Logic, Functional Analysis, etc.
- Honors and Awards: Sichuan University Comprehensive 2nd-Class Scholarship (2021-2022), Excellent Student of Sichuan University (2021-2022).

RESEARCH EXPERIENCE

Algebraicity of Equivariant Thom Spectra **Cambridge, MA**

Individual Research | Advisor: Prof. Hopkins Jerome Michael & Dr. Ishan Levy Apr. 2024 – Present

- Studied the algebraic properties of Thom spectra within the context of Equivariant Homotopy theory to determine a sufficient condition under which an equivariant Thom spectrum can be structured as an F_p-module valued Spectral Mackey functor;
- Conducted an in-depth study of foundational and advanced topics including Equivariant Homotopy theory, Equivariant Factorization Homology, Thom Spectra and Equivariant Hopkins-Mahowald Theorem, and developed a deep understanding of the algebraic criteria required for the Thom spectrum's classification.

Étale Cohomology (*Advanced Reading)* **Cambridge, MA**

Supervisor: Prof. Barry Mazur Sept. 2024 – Dec. 2024

- Referenced *Lectures on Étale Cohomology* by J.S. Milne to study the foundational aspects of étale cohomology;
- Authored appendices with detailed proofs on topics such as étale morphisms, the étale fundamental group, and fpqc descent;
- Explored the six functor formalism in the context of étale sheaves and the computational aspects of étale cohomology.

Algebraic K-theory (*Advanced Reading)* **Cambridge, MA**

Supervisor: Dhilan Lahoti (Ph.D. Student) Feb. 2024 – May 2024

- Studied recent papers on Algebraic K-theory, focusing on its universal construction, Topological Cyclic Homology, the Dundas-Goodwillie-McCarthy (DGM) trace theorem, and chromatically localized algebraic K-theory;

- Delivered a presentation named "Algebraic K-theory in a Nutshell" at the DRP symposium, giving a comprehensive overview of fundamental topics within Algebraic K-theory;
- Conducted a Zoom presentation on a modern proof of the DGM trace theorem, following Sam Raskin's notes;
- Composed detailed notes on "The algebraic K-theory of the $K(1)$ -local sphere via TC".

Group Actions on Infinite Categories and Hochschild Cohomology **Chengdu, China**

Independent Research June. 2023 – Jan. 2024

- Conducted an extensive review of foundational texts, including D. Huybrechts's Fourier–Mukai transforms in algebraic geometry, J. Lurie's Higher Topos Theory and Higher Algebra, to build the theoretical foundation;
- Generalized Prof. Alexander Perry's main theorem (For a k-linear stable ∞-category $\mathcal{C}$, the Hochschild cohomology of the homotopy fixed points, $HH^{\bullet}(\mathcal{C}^{G})$, splits and includes $HH^{\bullet}(\mathcal{C})^{G}$ as a summand); demonstrated that the k-linearity condition on $\mathcal{C}$ in the theorem was unnecessary;
- Initiated efforts to generalize the main theorem within the framework of topological K-theory, exploring potential applications in algebraic topology and higher algebra.

Algebraic Geometry Seminar **Chengdu, China**

Presenter | Instructor: Prof. Xiaojun Chen Oct. 2022 – June 2023

- Read chapters about "Varieties, Schemes and Cohomology" of *Algebraic Geometry* (by R. Hartshorne) under Prof. Chen's supervision to gain a deep understanding of foundational concepts in modern algebraic geometry;
- Explored the topics of varieties, schemes, and cohomology, and taught primary material and exercises from "Chapter 2: Schemes" to my fellow students;
- Expanded on the propositions in the textbook, providing additional context and background to enhance peers' comprehension, and offered rigorous proofs for 90% of the exercises in Chapter 2 by researching through academic resources, including the Stacks Project, and integrated the materials into comprehensive explanations for fellow students.

COMPLEMENTARY READINGS

- Unstable Motivic Homotopy Theory – by Thomas Brazelton (course)
- Chromatic Homotopy Theory - by Jacob Lurie
- Modular Abelian Varieties – by William Stein
- Representation Theory- taught by E. Smirnov (online course)

EXTRACURRICULAR ACTIVITY

Sichuan University Mathematical Modeling Association **Chengdu, China**

Vice President Sept. 2022 – July 2023

- Coordinated on-campus mathematical modeling competitions, including China Undergraduate Mathematical Contest in Modeling (CUMCM) and Mathematical Contest in Modeling (MCM), and organized related lectures with an average attendance of 100 students per session.

SKILLS

Technical: Latex, PARI/GP, SageMath, MATLAB, Mathematica, C++

Languages: Native in Mandarin, and fluent in English