

Peikai Qi

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Objective

I am currently a postdoc at the Morningside Center of Mathematics, Chinese Academy of Science, Beijing. My research interest is around elliptic curves, modular forms, class groups, Iwasawa modules, and Massey products.

Positions Held

2025-now **Postdoc in Mathematics**, *Morningside Center of Mathematics, Chinese Academy of Science*, Advisor: Xin Wan

Education

2019-2025 **Ph.D. in Mathematics**, *Michigan State University*, Advisor: Preston Wake
2015-2019 **Bachelor of Mathematics**, *Nankai University*

Award and Scholarship

SS 2024 TA Award for Excellence in Teaching
SS 2024 Dissertation Completion Fellowship
SS 2023 Herbert T. Graham Scholarship Fund

Writings

SS 2024 An Analogue of Greenberg's Conjecture for CM Fields(Joint with Matt Stokes, submitted)
SS 2024 p rationality and Iwasawa lambda invariant of a certain family of real quadratic fields(Joint with Matt Stokes, Submitted)
SS 2023 Iwasawa λ invariant and Massey products(Submitted)

Papers with Undergraduate Students

- Combinatorial and Analytical Properties of Higher-Order Recursive Polynomial Sequences(2023), joint with Luke Bridges, Max Budnick, Zachary Martin, Janine Wang, and Aklilu Zeleke. Draft in progress.
- Multivariate Fibonacci-like Polynomials and their Applications(2022), joint with Sejin Park, Etienne Phillips, Zhan Zhan, and Ilir Ziba.
- Universally uniformly continuous metric spaces(2017), joint with Katrina Gensterblum, and Willie Wong.

Referee

- Conference Proceedings of Women in Numbers 6
- Ramanujan Journal
- Canadian Journal of Mathematics

Invited talk

- Nov.30 2024 CMS winter meeting, An analogue of Greenberg pseudo-null conjecture for CM fields
- Nov.14 2024 Stockholm University, online, Iwasawa λ invariant and Massey products
- Oct.15 2024 The University of Texas at Austin, algebra seminar, Iwasawa λ invariant and Massey products
- Nov.13 2023 "Iwasawa λ invariant and Massey product", Fields institution number theory seminar, Video,<https://www.youtube.com/watch?v=82uHJV1Wa0w>
- Feb.20 2023 Michigan State University, Algebra seminar, Iwasawa lambda-invariants and Massey products

Conference(*presentation*)

- Jun.10-Jun.14 2024 Talk for "Iwasawa λ invariant and Massey product", Canadian Number Theory Association XVI, Fields institute, Canada
- May.31-Jun.02 2024 Talk for "An analogue to Grenberg conjecture", 9th Annual Graduate Student Conference in Algebra, Geometry, and Topology, Temple University, USA
- May.20-May.24 2024 Talk for "Iwasawa λ invariant and Massey product", 36th Automorphic Forms Workshop, Oklahoma State University, USA
- May.07-May.10 2024 Poster presentation for "Iwasawa λ invariant and Massey product", Local Systems in Algebraic Geometry, Ohio State University, USA
- Nov.11-Nov.13 2023 Talk for "Iwasawa λ invariant and Massey product", Binghamton University Graduate Combinatorics, Algebra, and Topology Conference, USA
- Nov.04-Nov.05 2023 Poster presentation for "Iwasawa λ invariant and Massey product", Western Algebraic Geometry Symposium, Washington University in St. Louis, USA
- Oct.13-Oct.15 2023 Poster presentation for "Iwasawa λ invariant and Massey product", Algebraic Geometry Northeastern Section, University of Pennsylvania, USA
- Oct.7-Oct.8 2023 Poster presentation for "Iwasawa λ invariant and Massey product", MAGNTS 2023 University of Michigan, USA
- Jul.31-Aug.4 2023 Lightning talk for "Iwasawa λ invariant and Massey product", Number Theory and Combinatorics in Duluth, USA
- May.26-May.28 2023 Talk for "Iwasawa λ invariant and Massey product", 2023 Graduate Student Conference in Algebra, Geometry, and Topology-Philadelphia, USA

Conference(*participated*)

- Aug.22-Aug.29 2024 2024 SUSTech conference in number theory and arithmetic geometry, Shenzhen, China

- Aug.01-Aug.03 2024 2024 Chen Jing-Run Prize Conference, Beijing, China
- Jun.13-Jun.16 2024 Workshop on Galois Cohomology and Massey Products A conference in honour of Jan Minac's 71st birthday, Ottawa, Canada
- Mar.9-Mar.11 2024 Southern Regional Number Theory Conference 2024, Baton Rouge, USA
- Mar.2-Mar.6 2024 Arizona Winter School 2024: Abelian Varieties, Tucson, USA
- Nov.18 2023 Michigan Algebraic Geometry Symposium-East Lansing, USA
- Oct.20-Oct.22 2023 FRG workshop on Brauer groups and derived categories-Chicago, USA
- Oct.16-Oct.20 2023 Group Theory and Number Theory: Interactions-Princeton USA
- May.15-May.19 2023 Algebraic geometry and cohomology in mixed characteristic-Chicago, USA
- May.09-May.11 2023 Representation Theory, L-functions, and Arithmetic-Pittsburgh, USA
- Mar.25 2023 Michigan Algebraic Geometry Symposium -Ann Arbor, USA
- Mar.04-Mar.08 2023 Arizona Winter School 2023: Unlikely Intersections (Arithmetic dynamics study group) -Tucson, USA
- Oct.22-Oct.23 2022 Midwest Arithmetic Geometry and Number Theory series 2022 -Chicago, USA
- Jul.24-Jul.30 2022 A Pair of Automorphic Workshops in 2022(Graduate instructional workshop)-Eugene, USA
- July.8 2022 Summer Undergraduate Michigan Mathematics Research (SUMMR) Conference-Dearborn,USA

Student seminar talk(given)

Student number theory-MSU

- Feb.9 2024 Almost Purity Theorem
- Oct.4 2023 Arithmetic Fuchsian Group
- Sep.13 2023 Modular Curve
- Feb.09 2023 Banach space over \mathbb{Q}_p
- Mar.16 2023 Everywhere convergent formal series and Riesz's theory II
- Sep.29 2022 Hecke algebra and Atkin-Lehner-Li's theory
- Sep.22 2022 Modular form and Hecke operator1
- Mar.21 2022 Alpha multiplication: functorial definition
- Mar.14 2022 Alpha multiplication: first approach
- Oct.26 2021 The reflex field of CM-pairs
- Nov.2 2021 The reflex field of CM-pairs, II
- Oct.19 2020 Algebraic function fields and global function fields
- Student algebra seminar-MSU
- Feb.20 2024 Knots and Primes
- Oct.6 2023 Introduction to Brauer Manin obstruction
- Feb.17 2022 Various versions of modularity theorem
- Oct.1 2021 structure of finite generated Lambda module and its adjoint

Alegebra learning seminar-MSU
Apr.05 2023 Galois categories

Student Seminar(Organized)

- FS 2022-SS 2023 Student number theory in MSU - eigenvariety
- FS 2023 Student number theory in MSU - Shimura Curve

Mentor

- May.15-Jul.7 2023 MSU REU Program. Working as mentor assistant to help Prof Aklilu Zeleke to mentor undergraduate students Luke Bridges, Max Budnick, Zachary Martin, and Janine Wang. We worked on the combinatorics proof of identity for some higher-order recursive polynomial sequences and analyze the behavior of the minimal root of recursive polynomial sequences.
- May.15-Jul.09 2022 MSU REU Program. Working as mentor assistant to help Prof Aklilu Zeleke to mentor undergraduate students Seijin Park, Etienne Phillips, Zhan Zhan, and Ilir Ziba. We worked on the Fibonacci like polynomials of multiple variables and found some identities and their relations with Bell polynomials, Fubini numbers, and Stirling numbers.
- Spring 2022 MSU Exchange program. Helping Professor Preston Wake to mentor Yingdong Li. We worked on calculating the structure of Hecke algebra over complex fields and write a package for Sage.

Teaching

- Fall 2024 Grading for MTH310(Abstract algebra) and writing solutions for MTH327H(analysis)
- Fall 2023 Teaching recitation for MTH234(Cal4) sections 005,022,031, grading, piazza and 3 MLC
- Spring 2023 Leading TA. Organizing TA meeting for MTH235(Cal4), leading discussion, providing help, giving feedback.
- Spring 2023 Teaching recitation for MTH299(Transition) sections 1,2. It is an introductory course for mathematical proof. Grading homework, writing solutions to homework, 1hr office hour per week, checking exam problems.
- Fall 2022 Leading TA. Observing the recitations or labs taught by ULA and writing feedback of their teaching to math department
- Fall 2022 Teaching recitation for MTH133(Cal2) sections 14,16,22, Grading and 4 MLC
- Spring 2022 Grader for MTH411(Group theory)
- Spring 2022 Teaching recitation for MTH133(Cal2, online),grading and 2 MLC.
- Fall 2021 Teaching recitation for MTH235(Cal4,online) section0 07,008,009 and teaching special projects for honor section. Grading, MLC and Piazza
- Spring 2021 Teaching recitation for MTH235(Cal4, online) for three sections. Grading, office hours and Piazza

Fall 2020 Teaching Assistant for qualifying course MTH818 Algebra1. Grading home-work and one hour office hours per week

Experience

Sep 2020-Aug 2021 **International student Liaison, AMS Graduate Student Chapter in MSU**
Coordinate the need of international student with the math department