Jiuya Wang – Curriculum Vitae

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Employment

2021-present Assistant Professor,
Department of Mathematics, University of Georgia

2018-2021 Phillip Griffiths Assistant Research Professor,
Department of Mathematics, Duke University

2018-2019 Foerster-Bernstein Postdoctoral Fellow,
Department of Mathematics, Duke University

Education

2013-2018 Ph.D. in Mathematics
Department of Mathematics, University of Wisconsin-Madison
Advisor: Prof. Melanie Matchett Wood

2009-2013 Bachelor in Mathematics
School of Mathematics and Computational Science, Sun Yat-sen University

Honors and Awards

2022-2025 **NSF Standard Grant, DMS-2201346**
three years with the total amount $162566

2019 **AMS Simons Travel Grant**
travel funding for early-career mathematician with $2000 yearly for two years awarded by AMS from Simons Foundation

2019 **AWM Dissertation Prize**
an annual award for up to three outstanding Ph.D. dissertations presented by female mathematical scientists and defended in US

2018 **Foerster Bernstein Fellowship**
one year postdoctoral fellowship, awarded to 2 women researchers in STEM fields yearly at Duke University

2017 **Excellence in Mathematical Research Award**
for significant and substantial contributions to research in mathematics, awarded by Department of Mathematics of University of Wisconsin Madison to graduate students

2017 **Math Department TA Awards**
are given to students who have demonstrated excellence in the classroom, awarded by Department of Mathematics of University of Wisconsin Madison to graduate students

2017 **Elizabeth S. Hirschfelder Prize**
for an outstanding female student who has demonstrated promise in their academic work, awarded by Department of Mathematics of University of Wisconsin Madison to female graduate students

2012 **Xuerou Li Scholarship**
18 awarded yearly to top undergraduates in Sun Yat-sen University

2011 **National Outstanding Paper & National First Prize**
Contemporary Undergraduate Mathematical Contest in Modeling

2009 - 2012 **Outstanding Student Scholarship (four times)**
yearly awarded to top undergraduates in Sun Yat-sen University

2009 - 2012 **China National Scholarship (four times)**
highest scholarship awarded to top students in universities in China yearly

Research Interest

I am interested in number theory on both the algebraic side and the analytic side. I am also interested in group theory, representation theory and algebraic geometry.

Publications

[14] Robert J. Lemke Oliver, Jiuya Wang, Melanie Matchett Wood *The average size of 3-torsion in class groups of 2-extensions* , arXiv: 2110.07712, submitted.

> *We determine the average size of the 3-torsion in class groups of G-extensions of a number field when G is any transitive 2-group containing a transposition, for example D_4. It follows from the Cohen–Lenstra–Martinet heuristics that the average size of the p-torsion in class groups of G-extensions of a number field is conjecturally finite for any G and most p (including $p \nmid |G|$). Previously this conjecture had only been proven in the cases of $G = S_2$ with $p = 3$ and $G = S_3$ with $p = 2$. We also show that the average 3-torsion in a certain relative class group for these G-extensions is as predicted by Cohen and Martinet, proving new cases of the Cohen–Lenstra–Martinet heuristics. Our new method also works for many other permutation groups G that are not 2-groups.*

[13] Ruiwen Shu, Jiuya Wang *Generalized Erdős-Turán Inequality and Stability of Energy Minimizers*, arxiv:2110.03019, submitted.

> *The classical Erdős-Turán inequality on the distribution of roots for complex polynomials can be equivalently stated in a potential theoretic formulation, that is, if the logarithmic potential generated by a probability measure on the unit circle is close to 0, then this probability measure is close to the uniform distribution. We generalize this classical inequality from $d = 1$ to higher dimensions $d > 1$ with the class of Riesz potentials which includes the logarithmic potential as a special case. In order to quantify how close a probability measure is to the uniform distribution in a general space, we use Wasserstein-infinity distance as a canonical extension of the concept of discrepancy. Then we give a compact description of this distance. Then for every dimension d, we prove inequalities bounding the Wasserstein-infinity distance between a probability measure ρ and the uniform distribution by the L^p-norm of the Riesz potentials generated by ρ. Our inequalities are proven to be sharp up to the constants for singular Riesz potentials. Our results indicate that the phenomenon discovered by Erdős and Turán about polynomials is much more universal than it seems. Finally we apply these inequalities to prove stability theorems for energy minimizers, which provides a complementary perspective on the recent construction of energy minimizers with clustering behavior.*

[12] Ruiwen Shu, Jiuya Wang *The Sharp Erdős-Turán Inequality* , arxiv: 2109.11006, submitted

> *Erdős and Turán proved a classical inequality on the distribution of roots for a complex polynomial in 1950, depicting the fundamental interplay between the size of coefficients of a polynomial and the distribution of its roots on the complex plane. Various results have been dedicated to improve the constant in this inequality, while the optimal constant remains open. In this paper we give the optimal constant, i.e., prove the sharp Erdős-Turán inequality. To achieve this goal, we reformulate the inequality into an optimization problem, whose equilibriums coincide with a class of energy minimizers with the logarithmic interaction and external potentials. This allows us to study their properties by taking advantage of the recent development of energy minimization and potential theory, and to give explicit constructions via complex analysis. Finally the sharp Erdős-Turán inequality is obtained based on a thorough understanding of these equilibrium distributions.*

[11] Emanuel Carneiro, Mithun Das, Alexandra Florea, Angel V. Kumchev, Amita Malik, Micah B. Milinovich, Caroline Turnage-Butterbaugh, and Jiuya Wang *Hilbert Transforms and the Equidistribution of Zeros of Poly-*

nomials , To appear in **Jounal of Functional Analysis**.

We improve the current bounds for an inequality of Erdös and Turán from 1950 related to the angular equidistribution of the zeros of a given polynomial. Building upon a recent work of Soundararajan, we establish a novel connection between this inequality and an extremal problem in Fourier analysis involving the maxima of Hilbert transforms, for which we provide a complete solution. Prior to Soundararajan (2019), refinements of the discrepancy inequality of Erdös and Turán had been obtained by Ganelius (1954) and Mignotte (1992).

[10] Jüergen Klüners, Jiuya Wang, *Idelic Approach in Enumerating Heisenberg Extensions* , submitted .

For odd primes ℓ and number fields k, we study the asymptotic distribution of number fields L/k given as a tower of relative cyclic C_ℓ-extensions $L/F/k$ using the idélic approach of class field theory. This involves a classification for the Galois group of L/k based on local conditions on L/F and F/k, and an extension of the method of Wright in enumerating abelian extensions. We call the possible Galois groups for these extensions generalized and twisted Heisenberg groups. We then prove the strong Malle–conjecture for all these groups in their representation on ℓ^2 points.

[9] Jiuya Wang, *Pointwise Bound for ℓ-torsion in Class Groups II: Nilpotent Extensions* , arXiv: 2004.11510, submitted for publication.

For every finite p-group G_p that is non-cyclic and non-quaternion and every positive integer $\ell \neq p$ that is greater than 2, we prove the first non-trivial bound on ℓ-torsion in class group of every G_p-extension. More generally, for every nilpotent group G where every Sylow-p subgroup $G_p \subset G$ is non-cyclic and non-quaternion, we prove a non-trivial bound on ℓ-torsion in class group of every G-extension for every integer $\ell > 1$. All results are unconditional and pointwise.

[8] Yeuk Hay Joshua Lam, Yuan Liu, Romyar Sharifi, Preston Wake and Jiuya Wang, *Generalized Bockstein maps and Massey products* , arXiv: 2004.11510, submitted for publication .

Given a profinite group G of finite p-cohomological dimension and a pro-p quotient H of G by a closed normal subgroup N, we study the filtration on the cohomology of N by powers of the augmentation ideal in the group algebra of H. We show that the graded pieces are related to the cohomology of G via analogues of Bockstein maps for the powers of the augmentation ideal. For certain groups H, we relate the values of these generalized Bockstein maps to Massey products relative to a restricted class of defining systems depending on H. We apply our study to give a new proof of the vanishing of triple Massey products in Galois cohomology.

[7] Riad Masri, Frank Thorne, Wei-Lun Tsai and Jiuya Wang, *Malle's Conjecture for $G \times A$ with $G = S_3, S_4, S_5$* , arXiv: 2004.04651, submitted for publication.

We prove Malle's conjecture for $G \times A$, with $G = S_3, S_4, S_5$ and A an abelian group. This builds upon work of the fourth author, who proved this result with restrictions on the primes dividing A.

[6] Jürgen Klüners and Jiuya Wang, *ℓ-torsion bounds for the class group of number fields with an ℓ-group as Galois group*, arXiv: 2003.12161, To appear in **Proceedings of the American Mathematical Society**.

We describe the relations among the ℓ-torsion conjecture for ℓ-extensions, the discriminant multiplicity conjecture for nilpotent extensions and a conjecture of Malle giving an upper bound for the number of nilpotent extensions. We then prove all of these conjectures in these cases.

[5] Jiuya Wang, *Pointwise Bound for ℓ-torsion in Class Groups: Elementary Abelian Extensions*, arXiv: 2001.03077, **Journal für die reine und angewandte Mathematik**, DOI: https://doi.org/10.1515/crelle-2020-0034.

Elementary abelian groups are finite groups in the form of $A = (\mathbb{Z}/p\mathbb{Z})^r$ for a prime number p. For every integer $\ell > 1$ and $r > 1$, we prove a non-trivial upper bound on the ℓ-torsion in class groups of every A-extension. Our results are pointwise and unconditional. This establishes the first case where for some Galois group G, the ℓ-torsion in class groups are bounded non-trivially for every G-extension and every integer $\ell > 1$. When r is large enough, the unconditional pointwise bound we obtain also breaks the previously best known bound shown by Ellenberg-Venkatesh under GRH.

[4] Robert J. Lemke Oliver, Jiuya Wang and Melanie Matchett Wood, *Inductive Methods for Proving Malle's Conjecture*, **Oberwolfach report** preliminary_OWR_2018_34.

We propose a general framework to inductively count number fields. By using this method, we prove the asymptotic distribution for extensions with Galois groups in the form of $T \wr B$ where $T = S_3$ or every abelian groups and B is an arbitrary group with the associated counting function not growing too fast.

[3] Jiuya Wang, *Malle's Conjecture for $S_n \times A$ for $n = 3, 4, 5$*, arXiv: 1705.00044, accepted at **Compositio Mathematica**.

We propose a framework to prove Malle's conjecture for the compositum of two number fields based on proven results of Malle's conjecture and good uniformity estimates. Using this method we can prove Malle's conjecture for $S_n \times A$ over any number field k for $n = 3$ with A an abelian group of order relatively prime to 2, for $n = 4$ with A an abelian group of order relatively prime to 6 and for $n = 5$ with A an abelian group of order relatively prime to 30. As a consequence, we prove that Malle's conjecture is true for $C_3 \wr C_2$ in its S_9 representation, whereas its S_6 representation is the first counter example of Malle's conjecture given by Klüners.

[2] Jiuya Wang, *Secondary Term of the Asymptotic Estimate of $S_3 \times A$ Extensions over $\mathbb{Q}$*, arXiv: 1710.10693, submitted for publication.

We combine a sieve method together with good uniformity estimates to prove a secondary term for the asymptotic estimate of $S_3 \times A$ extensions over $\mathbb{Q}$ when A is an odd abelian group with minimal prime divisor greater than 5. At the same time, we prove the existence of a power saving error when A is any odd abelian group.

[1] Nigel Boston and Jiuya Wang, *The 2-Class Tower of $\mathbb{Q}(\sqrt{-5460})$*, arXiv: 1710.10681, **Geometry, Algebra, Number Theory, and Their Information Technology**, Toronto, Canada, June 2016 and Kozhikode, India, August 2016.

The seminal papers in the field of root-discriminant bounds are those of Odlyzko and Martinet. Both papers include the question of whether the field $\mathbb{Q}(\sqrt{-5460})$ has finite or infinite 2-class tower. This is a critical case that will either substantially lower the best known upper bound for lim inf of root-discriminants (if infinite) or else give a counterexample to what is often termed Martinet's conjecture or question (if finite). Using extensive computation and introducing some new techniques, we give strong evidence that the tower is in fact finite, establishing other properties of its Galois group en route.

Invited Talks

2022 April	Number Theory Seminar, University of Illinois at Urbana-Champainge
2022 March	AMS Sectional Meeting, Tufts University
2022 Feb	Number Theory Seminar, University of Mississippi
2021 Nov	Number Theory Seminar, Tsinghua University
2021 Oct	Number Theory Seminar, University of Georgia
2021 July	WASP, online seminar
2021 May	Number Theory Seminar, University of Arizona, online seminar
2021 April	Number Theory Seminar, OSU, online seminar
2021 March	Berkeley-Caltech-Stanford virtual number theory seminar, online seminar
2021 Feb	Number Theory Seminar, UCSB, online seminar
2021 Jan	Number Theory Seminar, UCLA, online seminar
2020 Dec	Colloquium, University of Waterloo, online seminar
2020 Dec	Colloquium, Maryland, online seminar

2020 Dec	Colloquium, TAMU, online seminar
2020 Nov	Number Theory Seminar, MIT, online seminar
2020 Sept	Number Theory Seminar, Harvard University, online seminar
2020 July	MAGIC: Michigan - Arithmetic Geometry Initiative - Columbia, online seminar
2020 June	Canadian Math Meeting, Ottawa, ON (postponed)
2019 Dec	PANTS, Clemson University, Columbus, SC
2019 Dec	Number Theory Seminar, University of Waterloo, Waterloo, ON
2019 Dec	Canadian Math Meeting, Toronto, ON
2019 Nov	Number Theory Seminar, John Hopkins University, Baltimore, MD
2019 Nov	Number Theory Seminar, University of South Carolina, Columbus, SC
2019 June	Max Planck Institute, Bonn, Germany
2019 April	AWM Research Symposium, Houston, TX
2019 March	Hawaii Number Theory Conference, Hawaii
2019 Feb	Number Theory Seminar, University of Toronto, ON, Canada
2019 Jan	Joint Math Meetings 2019, Baltimore, MD
2018 Nov	Number Theory Seminar, Duke University, Durham, NC
2018 Oct	Number Theory Seminar, Emory University, Atlanta, GA
2018 July	Explicit Methods in Number Theory, Oberwolfach, Germany
2018 April	AMS meeting, Northeastern University, Boston, MA
2018 Feb	Number Theory Seminar, Tufts University, Boston, MA
2017 Nov	Number Theory Seminar, University of Washington, Seattle, WA

Teaching

2022 Fall	Math 2250: Calculus 1
2022 Spring	Math 3000: Linear Algebra
2021 Fall	Math 3300: Applied Linear Algebra
2021 Spring	Math 401: Abstract Algebra
2020 Fall	Math 212: Multi-variable Calculus
2020 Spring	Math 401: Abstract Algebra
2017 Spring	Math 234: Multi-variable Calculus
2016 Fall	Math 234: Multi-variable Calculus
2015 Summer	Math 211: Business Calculus
2015 Spring	Math 234: Multi-variable Calculus
2014 Fall	Math 211: Business Calculus
2014 Spring	Math 171: Calculus 1
2013 Fall	Math 222: Calculus 2

Activity

2022 Spring organizer for reading seminar, University of Georgia
Class Groups of Quadratic Fields

2020 Summer coleader for DoMath with Samit Dasgupta (Undergrad Research Program at Duke University), Duke University
Representation Theory with Applications in Statistics of Class Groups

2019 Fall-2020 Spring organizer/main speaker for reading seminar, Duke University
Cohomology of Number Fields

2019 Spring coorganizer for a special session in 2019 Joint Math Meetings with Lillian Pierce and Arindam Roy, Baltimore, MD
Counting Methods in Number Theory