

# William Yun Chen

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## Contact

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Citizenship United States of America

## Education

2010–2016 **PhD, Mathematics, 2016**, *Pennsylvania State University, University Park, PA, 16802.*  
Advisor Wen-Ching Winnie Li  
Area Algebraic geometry, number theory, group theory  
Thesis *Moduli Interpretations for Noncongruence Modular Curves*  
2005–2009 **BA, Mathematics**, *Dartmouth College, Hanover, NH, 03755.*

## Employment

2022-2023 Hill Assistant Professor, Rutgers University, New Brunswick, NJ  
2021-2022 Member, Institute for Advanced Study, Princeton, NJ  
2019-2021 NSF Postdoctoral Fellow, Columbia University, New York, NY  
2018-2019 NSF Postdoctoral Fellow, McGill University, Montreal, Canada  
2016-2018 Member, Institute for Advanced Study, Princeton, NJ

## Grants, honors, and awards

2018-2021 NSF Postdoctoral Fellow  
Apr 2016 Raymond and Christine Ayoub Award for outstanding thesis in algebra or number theory, Pennsylvania State University  
Sep 2015 Vollmer-Kleckner Scholarship in Science, Pennsylvania State University  
Apr 2015 Pritchard Dissertation Fellowship, Pennsylvania State University

## Publications and Preprints

- 2023 *Families of elliptic curves over the four-pointed configuration space and a sequence of Dyer-Formanek-Grossman*, with Nick Salter.
- 2023 *Finite simple characteristic quotients of the free group of rank 2* (20 pages), with Alex Lubotzky, Danny Neftin, and Pham Huu Tiep. To appear in *Commentarii Mathematici Helvetici*.
- 2023 *Remarks on the  $\mathbb{Z}/p$  Dijkgraaf-Witten invariants of 3D mapping tori* (16 pages), with Alex Kontorovich and Shehryar Sikander. Submitted. Arxiv preprint: <https://arxiv.org/abs/2306.10206>
- 2021 *Nonabelian level structures, Nielsen equivalence, and Markoff triples* (96 pages), to appear in *Annals of Math* (2022) <https://annals.math.princeton.edu/articles/20273> Arxiv preprint: <https://arxiv.org/abs/2011.12940>.

- 2020 *Tamely ramified covers of the projective line with alternating and symmetric monodromy* (53 pages), with Renee Bell, Jeremy Booher, and Yuan Liu. *Algebra Number Theory* **16** (2022), no. 2, 393-446. <https://doi.org/10.2140/ant.2022.16.393>, MR4412578. Arxiv preprint: <https://arxiv.org/abs/2007.12299>.
- 2018 *Arithmetic monodromy actions on pro-metabelian fundamental groups of once-punctured elliptic curves* (38 pages), with Pierre Deligne. Latest version: <https://www.williamyunchen.com/metabelian.pdf> Arxiv preprint: <https://arxiv.org/abs/1710.05532>
- 2017 *Moduli Interpretations for Noncongruence Modular Curves* (85 pages), *Math. Ann.* **371** (2018), no. 1-2, 41-126. <https://doi.org/10.1007/s00208-017-1575-6>, MR3788845. Arxiv preprint: <https://arxiv.org/abs/1510.05687>

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## Expository Notes and Computing

- 2021 *Two base change results for rings of invariants*, available at: [www.williamyunchen.com](http://www.williamyunchen.com). This is a short note explaining two base change results for rings of invariants. The first is a classical theorem in invariant theory, the second is a base change result for character varieties of representations of a free group in a split reductive group.
- 2017 *Katz modular forms*, available at: [www.williamyunchen.com](http://www.williamyunchen.com). These are some detailed expository notes describing the correspondence between classical modular forms defined as holomorphic functions on the upper half plane and sections of the Hodge bundle on stacks finite etale over the moduli stack of elliptic curves. I do this in a way that works for any finite index subgroup of  $SL_2(\mathbb{Z})$ , and describe some arithmetic consequences for noncongruence modular forms/curves.
- 2016-2021 I have written a significant amount of code to compute the geometry of the moduli stacks  $\mathcal{M}(G)$  of elliptic curves with  $G$ -structures. The code is available at [www.williamyunchen.com](http://www.williamyunchen.com). Some of the results of the computations can be found in Appendix B of my *Moduli Interpretations* paper. I hope to eventually incorporate the code/data into the [lmfdb.org](http://lmfdb.org).

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## Service and other activities

- Referee *Journal of the AMS, Mathematische Annalen, Mathematische Zeitschrift, Experimental Mathematics, Mathematika*
- Contributor *The Stacks Project* <https://stacks.math.columbia.edu/contributors>
- 2023 Co-organizer of the JMM special session *Modular Forms, Hypergeometric Functions, Character Sums, and Galois Representations* in Boston, MA
- 2017-18 Co-organizer of the Princeton/IAS Number Theory Seminar
- Oct 2013 Organizer and Presenter - *Think Outside the Beaker - Seven Bridges of Königsberg*  
Together with my colleague Shahrzad Jamshidi, we designed, presented, and helped organize a 90-minute session to engage local middle school students in an active hands-on experience in graph theory through problems related to the “Seven Bridges of Königsberg” and Eulerian circuits. This was part of the Penn State Eberly College of Science’s *Think Outside the Beaker* outreach program, sponsored by *Science-U*.
- Jun-Jul 2009 Counselor, *Ross Mathematics Program*, Ohio State University
- Jun-Aug 2008 Software Development Engineer Intern, Microsoft, Boulder, CO

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## Teaching Experience

- Spring 2023 Instructor, Math 356, *Theory of Numbers*, Rutgers University
- Spring 2023 Instructor, Math 135, *Calculus I*, Rutgers University
- Fall 2022 Instructor, Math 350, *Linear Algebra*, Rutgers University
- Summer 2021 Instructor, Math 3020, *Number theory and cryptography*, Columbia University
- Spring 2020 Instructor, Math 1101, *Calculus I*, Columbia University
- Spring 2016 Instructor, Math 251, *Ordinary and Partial Differential Equations*, Penn. State University

- Spring 2015 Grader, Math 536, *Abstract Algebra*, Pennsylvania State University  
 Fall 2014 Instructor, Math 41, *Trigonometry and Analytic Geometry*, Pennsylvania State University  
 Fall 2013 Instructor, Math 21, *College Algebra I*, Pennsylvania State University  
 Fall 2012 Instructor, Math 21, *College Algebra I*, Pennsylvania State University  
 Fall 2011 Instructor, Math 220, *Matrices*, Pennsylvania State University  
 Summer 2011 Instructor, Math 220, *Matrices*, Pennsylvania State University  
 Spring 2011 Instructor, Math 17, *Finite Mathematics*, Pennsylvania State University

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## Research Talks

- June 2023 “Strong approximation for the Markoff equation and connectedness of Hurwitz spaces”, Institute for Advanced Study at Zhejiang University, Hangzhou, China
- Oct 2022 *Number/Representation theory seminar*, “Strong approximation for the Markoff equation and connectedness of Hurwitz spaces”, University of Toronto, Toronto, CA
- Sep 2022 *Rutgers Number Theory Seminar*, Rutgers University, New Brunswick, NJ
- Aug 2022 Conference on *Specialization and Effectiveness in Number Theory*, BIRS, Banff, CA. Slides available at <http://www.birs.ca/workshops/2022/22w5024/files/>
- Mar 2022 *Number Theory Web Seminar* (online). Video and notes available at <https://www.ntwebseminar.org/previous-talks>
- Mar 2022 *Algebra Seminar*, University of Pennsylvania, PA
- Mar 2022 *Number Theory seminar* (online), University of Wisconsin, WI
- Mar 2022 *Trimester Program on Triangle Groups, Belyi Uniformization, and Modularity* (online), Bhaskaracharya Pratishthana, Pune, India. Video available at <https://youtu.be/xW3B3Y-HCwU>
- Nov 2021 *International Seminar on Automorphic Forms* (online), TU Darmstadt, Germany
- Nov 2021 *Number Theory seminar*, Northwestern University, IL
- Nov 2021 *Arithmetic Groups seminar*, Institute for Advanced Study, Princeton, NJ
- Apr 2021 *Joint Berkeley-Caltech-Stanford number theory seminar* (online), “Markoff triples, Nielsen equivalence, and nonabelian level structures”.
- Mar 2021 *Joint Columbia-CUNY-NYU number theory seminar* (online), “Markoff triples, Nielsen equivalence, and nonabelian level structures”. Video available at <https://youtu.be/SNTpL9SoVF4>
- Feb 2021 *Séminaire de géométrie arithmétique et motivique (Paris Nord)* (online), “Markoff triples, Nielsen equivalence, and nonabelian level structures”
- Nov 2020 *Princeton/IAS Number theory seminar* (online), “Strong approximation for the Markoff equation via nonabelian level structures on elliptic curves”. Video available at <https://youtu.be/b4G5KBQxrRM>
- Oct 2019 *Algebraic geometry seminar*, Columbia University, New York, NY
- Jul 2019 Two talk series at *Number Theory Days*, Hong Kong University, Hong Kong
- Jun 2019 *AMS MRC on Explicit methods in arithmetic geometry in characteristic  $p$* , Whispering Pines Conference Center, RI
- May 2019 *Number Theory Seminar*, University of Oregon, Eugene, OR
- April 2019 Plenary talk at the *Southern Regional Number Theory Conference*, Louisiana State University, Baton Rouge, LA
- Dec 2018 *Number Theory Lunch Seminar*, Max Planck Institute for Mathematics, Bonn, Germany
- Dec 2018 Colloquium talk at University of Vermont, Burlington, VT
- Nov 2018 *Algebra and Geometry Seminar*, Université Laval, Quebec City, Canada
- Sep 2018 *Quebec-Vermont Number Theory Seminar*, McGill University, Montreal, Canada
- Jun 2018 *Pan Asia Number Theory Conference*, National University of Singapore, Singapore

- Jun 2018 *New Developments in Arithmetic Geometry Conference*, Institute for Advanced Study, Tsinghua University, China
- Feb 2018 *Number Theory Seminar*, Duke University, Durham, NC
- Oct 2017 *Algebra and Number Theory Seminar*, Yale University, New Haven, CT
- Apr 2017 *Number Theory Seminar*, Dartmouth College, Hanover, NH
- Jan 2017 *Algebra Seminar*, University of Pennsylvania, Philadelphia, PA
- Nov 2016 *Mathematical Conversations*, Institute for Advanced Study, Princeton, NJ
- Oct 2016 *Number Theory Seminar*, Princeton University, Princeton, NJ
- Oct 2016 *Number Theory Seminar*, Harvard University, Cambridge, MA
- Feb 2016 *Group, Lie, and Number Theory Seminar*, University of Michigan, Ann Arbor, MI
- Jan 2016 *Quebec-Vermont Number Theory Seminar*, McGill University, Montreal, Canada
- Aug 2015 *Illinois Number Theory Conference*, University of Illinois at Urbana-Champaign, Urbana-Champaign, IL
- Apr 2015 *Workshop on Algebraic Varieties, Hypergeometric Series, and Modular Forms*, The Louisiana State University, Baton Rouge, LA
- Apr 2015 *Upstate Number Theory Conference*, Cornell University, Ithaca, NY
- Feb 2015 *Algebra and Number Theory Seminar*, The Pennsylvania State University, University Park, PA
- Jan 2015 Short talk at *AMS Joint Mathematics Meetings, Special Session on Recent Developments in Algebraic Number Theory*, San Antonio, TX

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## Informal talks

- April 2023 *Rutgers Undergraduate Mathematical Association*, “Groups, numbers, and the moduli of elliptic curves”, Rutgers University, New Brunswick, NJ
- Feb 2022 *Mathematical Conversations*, “Lego in finite groups, Hurwitz spaces, and Markoff triples”, Institute for Advanced Study, Princeton, NJ
- Feb 2019 *Adic spaces learning seminar*, “Perfectoid Rings”, McGill University, Montreal, Canada
- Feb 2018 *Taylor Working Seminar*, “Witt vectors”, Institute for Advanced Study, Princeton, NJ
- Nov 2016 *Mathematical Conversations*, “Moduli interpretations for noncongruence modular curves”, Institute for Advanced Study, Princeton, NJ
- Apr 2012 *Graduate Student Seminar*, “Error correcting codes”, Pennsylvania State University, State College, PA

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## Conferences and Workshops Attended

- Aug 2022 *Specialization and Effectiveness in Number Theory*, Banff International Research Station, Banff, CA
- Jan 2020 Joint Math Meetings, Denver, CO
- Mar 2017 Arizona Winter School - *Perfectoid Spaces*, University of Arizona, Tucson, AZ
- Sep 2016 *Kummer Classes and Anabelian Geometry*, University of Vermont, Burlington, VT
- May 2016 *Fundamental Groups in Arithmetic Geometry*, IHP and ENS, Paris, France
- Nov 2015 *Moduli Spaces and Arithmetic Geometry*, The Lorentz Center, Leiden, The Netherlands
- Sep 2015 *Modular Forms and Curves of Low Genus: Computational Aspects*, ICERM, Providence, RI
- Oct 2015 Poster presented at the *Workshop on Explicit Methods for Modularity of K3 Surfaces and Other Higher Weight Motives*, ICERM, Providence, RI
- Oct 2015 Poster presented at AGNES, Brown University, Providence, RI
- Sep-Dec 2015 Semester Program on *Computational Aspects of the Langlands Program*, ICERM, Providence
- Aug 2014 *Special Lectures in Number Theory*, National Center for Theoretical Sciences, National Tsing Hua University, Hsinchu, Taiwan

- Jul 2014 Poster presented at the *Conference on the Impact of Computation in Number Theory*, at the National Center for Theoretical Sciences (NCTS), National Tsing Hua University, Hsinchu, Taiwan.
- Apr 2014 AGNES, Stony Brook University, Stony Brook, NY
- Apr 2014 *Applications of Automorphic Forms in Number Theory and Combinatorics*, The Louisiana State University, Baton Rouge, LA
- Oct 2013 AGNES, Boston College, Boston, MA
- Jul 2013 *Special Week in Arithmetic and Number Theory*, National Center for Theoretical Sciences, National Tsing Hua University, Hsinchu, Taiwan
- Jun 2013 *International Workshop on Transcendence and Number Theory*, National Center for Theoretical Sciences, National Tsing Hua University, Hsinchu, Taiwan
- Mar 2013 Arizona Winter School – *Modular Forms and Modular Curves*, University of Arizona, Tucson, AZ
- Apr 2012 *Atkin Memorial Lecture and Workshop, Elliptic Curves over  $\mathbb{Q}(\sqrt{5})$* , University of Illinois Chicago, Chicago, IL
- Mar 2012 Arizona Winter School – *Ramification and Geometry*, University of Arizona, Tucson, AZ
- Apr 2011 *Atkin Memorial Lecture and Workshop Noncongruence Modular Forms and Galois representations*, University of Illinois Chicago, Chicago, IL