CURRICULUM VITAE

Will Sawin

Columbia University
Department of Mathematics
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PROFESSIONAL EXPERIENCE

Columbia University *2018 - present*
Assistant Professor
(tenure-track)

Clay Mathematics Institute *2018 - 2021*
Clay Research Fellow

Institute for Theoretical Studies – ETH Zurich *2016 - 2018*
Junior Fellow
(postdoctoral research position)

EDUCATION

Princeton University *2016*
Ph.D. in Mathematics
Advisor: Nicholas M. Katz
Topic: A Tannakian Category and a Horizontal Equidistribution Conjecture for Exponential Sums

Yale University *2011*
B. S. in Mathematics and Economics with Honors

PUBLICATIONS

- A geometric approach to the sup-norm problem for automorphic forms: the case of newforms on $GL_2(\mathbb{F}_q(T))$ with squarefree level, *Proceedings of the London Mathematical Society* **123** (2021)
- On the Ramanujan conjecture for automorphic forms over function fields I: Geometry, *JAMS*, **34** (2021) (with Nicolas Templier)
- Square-root Cancellation for Sums of Factorization Functions over Short Intervals in Function Fields, *Duke Mathematical Journal*, **170** (2021)
- Representation of squares by nonsingular cubic forms, *Israel Journal of Mathematics*, (2021) (with Lasse Grimmelt)
- Free rational points on smooth hypersurfaces, *Commentarii Mathematici Helvetici*, **95** (2020) (with Tim Browning)
- Singularities and vanishing cycles in number theory over function fields, in PIMS Workshop on Arithmetic Topology conference proceedings, a special issue of *Research in the Mathematical Sciences*
- Improved Estimates for Polynomial Roth Type Theorems in Finite Fields, *Journal d'Analyse Mathematique*, **141** (2020) (with Dong Dong and Xiaochun Li)
- A Representation Theory Approach to Integral Moments of L-functions over Function Fields, *Algebra & Number Theory*, **14** (2020)

- Dynamical Models for Liouville and Obstructions to Further Progress on Sign Patterns, *Journal of Number Theory Prime*, **213** (2020)
- A Geometric Version of the Circle Method, *Annals of Mathematics*, **191** (2020) (with Tim Browning)
- Correlations of arithmetic functions over $\mathbb{F}_q[T]$, *Mathematische Annalen*, **376** (2020) (with Ofir Gorodetsky)
- Periodic twists of GL_3-modular forms, *Forum of Mathematics: Sigma*, **8** (2020) (with Emmanuel Kowalski, Yongxiao Lin, and Philippe Michel)
- Irreducibility of Polynomials with Large Gap, *Acta Arithmetica*, **192** (2020) (with Mark Shusterman and Michael Stoll)
- Chebotarev Density Theorem in Short Intervals for Extensions of $\mathbb{F}_q(T)$, *Transactions of the American Mathematical Society*, **373** (2020) (with Lior Bary-Soroker, Ofir Gorodetsky, and Taelin Karidi)
- *COPT: Coordinated optimal transport on graphs*, NeurIPS 2020 (with Yihe Dong)
- $\overline{M}_{1,n}$ is Usually not Uniruled in Characteristic p, *Épijournal de Géométrie Algébrique*, **3** (2019)
- Bounds for Matchings in Nonabelian Groups, *Electronic Journal of Combinatorics*, **25** (2018)
- The Growth Rate of Tri-Colored Sum-Free Sets, *Discrete Analysis*:13 (2018) (with Robert Kleinberg and David E. Speyer)
- Ramanujan Coverings of Graphs, *Advances in Mathematics*, **323** (2018) (with Chris Hall and Doron Puder) (also appearing in STOC 2016)
- Bilinear Forms with Kloosterman Sums and Applications, *Annals of Mathematics*, **186** (2017) (with Emmanuel Kowalski and Philippe Michel)
- Upper Bounds for Sunflower-Free Sets, *Forum of Mathematics Sigma*, **5** (2017) (with Eric Naslund)
- On Capsets and the Group-Theoretic Approach to Matrix Multiplication, *Discrete Analysis* (2017) (with Jonah Blasiak, Thomas Church, Henry Cohn, Joshua A. Grochow, Eric Naslund, and Chris Umans)
- Non-Existence of Smooth Rational Cohomology Tori of General Type – appendix to Rational Cohomology Tori by Olivier Debarre, Zhi Jiang, and Martí Lahoz, *Geometry & Topology*, **21** (2017)
- Kloosterman Paths and the Shape of Exponential Sums, *Compositio Mathematica*, **52** (2016) (with Emmanuel Kowalski)
- Ordinary Primes for Abelian Surfaces, *Comptes Rendus Mathematique*, **354**, No. 6 (2016)
- Notes on Commutation of Limits and Colimits, *Theory and Applications of Categories*, **30** (2015) (with Marie Bjerrum, Peter Johnstone, and Tom Leinster)
- Certifying the Restricted Isometry Property is Hard, *IEEE Transactions on Information Theory*, **59**, No. 6 (2013) (with Afonso S. Bandeira, Edgar Dobriban, and Dustin G. Mixon)

To Appear:

- *Bounds for the stalks of perverse sheaves in characteristic p and a conjecture of Shende and Tsimerman* (to appear in Inventiones Mathematica) (with an appendix by Jacob Tsimerman)
- The Second Moment Theory of Families of L-functions (to appear in *Memoirs of the AMS*) (with Valentin Blomer, Étienne Fouvry, Emmanuel Kowalski, Philippe Michel, and Djordje Milićević)

- Stratification and averaging for exponential sums: Bilinear Forms with Generalized Kloosterman Sums (to appear in *Annali della Scuola Normale Superiore de Pisa*) (with Emmanuel Kowalski and Philippe Michel)

Submitted:

- *On the Chowla and twin primes conjectures over* $\mathbb{F}_q[T]$ (with Mark Shusterman)
- *The Shafarevich conjecture for hypersurfaces in abelian varieties* (with Brian Lawrence)
- *The Hasse principle for random Fano hypersurfaces* (with Tim Browning and Pierre Le Boudec)
- *Möbius cancellation on polynomial sequences and the quadratic Bateman-Horn conjecture over function fields* (with Mark Shusterman)
- *Square-root cancellation for sums of factorization functions over squarefree progressions in* $\mathbb{F}_q[t]$
- *Quantitative sheaf theory* (with Arthur Forey, Javier Fresán, and Emmanuel Kowalski)
- *The Zariski topology, linear systems, and algebraic varieties* (with János Kollár, Max Lieblich, and Martin Olsson)
- *Cohen-Lenstra heuristics and bilinear pairings in the presence of roots of unity* (with Michael Lipnowski and Jacob Tsimerman)
- *Free Rational Curves on Low Degree Hypersurfaces and the Circle Method* (with Tim Browning)
- *Identifying measures on non-abelian groups and modules from their moments via reduction to a local problem*
- *Freeness alone is insufficient for Manin-Peyre*
- *An improved lower bound for multicolor Ramsey numbers and the half-multiplicity Ramsey number problem*
- *Algebraic twists of* $GL_3 \times GL_2$ *L-functions* (with Yongxiao Lin and Philippe Michel)
- *The Equidistribution of L-functions of Twists by Witt Vector Dirichlet Characters over Function Fields*

Preprints:

- *Local parameters of supercuspidal representations* (with Michael Harris and Gan Wee Teck)

AWARDS

- SASTRA Ramanujan Prize (2021)
- Clay Research Fellowship (2018)
- NSF Graduate Research Fellowship (2013)
- George Beckwith Prize (2011)

COLLOQUIUM TALKS

- **University of Michigan** – 12/21 – *Finite quotients of 3-manifold groups*
- **Princeton University** – 2/20 – *The Twin Primes and Chowla conjectures in* $\mathbb{F}_q[T]$
- **Harvard-Brandeis-MIT-Northeastern** – 9/19 – *On Chowla's Conjecture over* $\mathbb{F}_q[T]$
- **University of Wisconsin Madison** – 9/19 – *On Chowla's Conjecture over* $\mathbb{F}_q[T]$

- **University of Minnesota** – 12/18 – *Number theory over function fields and geometry*

CONFERENCE TALKS

- **Explicit Methods in Number Theory** – 7/21 – MFO, Oberwolfach – *Moments, measures, and non-abelian Cohen Lenstra*
- **Geometry from Arithmetic** – 7/21 – Banff International Research Station – *The Geometric Manin's Conjectures*
- **Around Frobenius Distributions and Related Topics** – 6/21 – UIC / MIT – *Frobenius distribution in number theory over function fields*
- **Rational Points and Galois Representations** – 5/21 – University of Pittsburgh – *The Shafarevich conjecture for hypersurfaces in abelian varieties*
- **2020 Canadian Mathematics Society Annual Meeting** – Scientific Session on Arithmetic Statistics – 11/20 – *Measures from moments for random groups*
- **2020 Canadian Mathematics Society Annual Meeting** – Scientific Session on Equidistribution in Arithmetic Manifolds – 11/20 – *The mixing conjecture over function fields*
- **German Mathematics Society Annual Meeting** – Minisymposium: Differential and Hodge Theoretic Methods in Algebraic Geometry – 9/20 – *The Shafarevich conjecture for hypersurfaces in abelian varieties*
- **Automorphic Forms and Arithmetic** – 9/20 – MFO, Oberwolfach – *Questions on exact large values of automorphic forms*
- **Online Conference in Automorphic Forms** – 6/20 – Budapest – *The sup-norm problem for automorphic forms over function fields*
- **Analytic Number Theory** – 11/19 – MFO, Oberwolfach – *On the Chowla conjecture over* $\mathbb{F}_q[T]$
- **L-Functions and Geometric Representation Theory** – 7/19 – Nisyros – *A geometric approach to the sup-norm problem over function fields*
- **PIMS Workshop on Arithmetic Topology** – 6/19 – Pacific Institute of Mathematical Sciences – *The circle method and the cohomology of moduli spaces of rational curves*
- **Points rationnels sur les variétés de Fano ou similaires** – 5/19 — Institut Henri Poincaré – *On a conjecture of Poonen and Voloch I: Probabilistic models for counting rational points on random Fano hypersurfaces*
- **Workshop on Arithmetic Geometry** – 3/19 – University of Tokyo – *The sup-norm problem and stalks of perverse sheaves*
- **Trace Functions Winter School** – 1/19 – ETH Zurich Congressi Stefano Franscini – mini-course on *Advanced formalism of trace functions*
- **Explicit Methods in Number Theory** – 7/18 – MFO, Oberwolfach – *New invariants on class groups and Cohen-Lenstra heuristics in the presence of roots of unity*
- **Canadian Number Theory Association XV** – 7/18 – Université Laval – *L-functions of Dirichlet Character Twists over Function Fields*
- **Perspectives on the Riemann Hypothesis** – 6/18 – University of Bristol / Heilbronn Institute – *More on Zeroes of L-functions over Function Fields*
- **Workshop on Additive Combinatorics** – 10/17 – Harvard – *Constructions of Additive Matchings*

- **Analytic Number Theory** – 9/17 – MFO, Oberwolfach – *On the Ramanujan Conjecture for Automorphic Forms over Function Fields*
- **Recent Developments in Analytic Number Theory** – 5/17 – MSRI – *Applications of Exponential Sums*
- **Introductory Workshop on Analytic Number Theory** – 2/17 – MSRI – *Trace Functions and Special Functions*
- **Workshop on Expanders and Extractors** – 1/17 – UC Berkeley – *Ramanujan Covers*
- **4th Israeli Algebra and Number Theory Day** – 12/16 – Tel Aviv University – *The Distribution of L-functions of Character Twists*
- **Recent Breakthroughs in the Polynomial Method** – 9/16 – Heilbronn Institute – *Slice Rank and Sunflowers* and *Lower Bounds for Slice Rank* (workshop talks)
- **Geometric and Analytic Number Theory** – 9/16 – ETH Zurich – *The Slice Rank Method in Additive Combinatorics*
- **AMS Summer Institute in Algebraic Geometry** – 7/15 – University of Utah – *Applications of Algebraic Geometry to Analytic Number Theory* (contributed lecture)

SEMINAR TALKS

- **Yale University (geometry, symmetry, and physics seminar)** – 10/21 – *The sup norm-problem, Hecke eigensheaves, and the polar multiplicities of the nilpotent cone*
- **Princeton University (number theory seminar)** – 9/21 – *Sums in progressions over $\mathbb{F}_q[T]$, the symmetric group, and geometry*
- **HU Berlin (Algebra, Geometry & Physics seminar)** – 5/21 – *Is freeness enough for counting rational points?*
- **VaNTAGe** – 5/21 – *The freeness alternative to thin sets in Manin's conjecture*
- **Brown University (algebra seminar)** – 4/21 – *The Shafarevich conjecture for hypersurfaces in abelian varieties*
- **Princeton University (number theory seminar)** – 3/21 – *The Shafarevich conjecture for hypersurfaces in abelian varieties*
- **Université Paris 13 (arithmetic and motivic geometry seminar)** – 3/21 – *Cohen-Lenstra heuristics in the presence of roots of unity*
- **Peking University - Westlake University (algebraic geometry seminar)** – 2/21 – *Bounding the stalks of perverse sheaves in characteristic p*
- **American Institute of Mathematics (FRG on moments and divisor correlations seminar)** – 2/21 – *(Almost) square-root cancellation for sums to squarefree moduli in $\mathbb{F}_q[t]$, with applications to Dirichlet L-functions of squarefree conductor*
- **Stanford - Berkeley - CalTech (number theory seminar)** – 1/21 – *The Shafarevich conjecture for hypersurfaces in abelian varieties*
- **UCLA (number theory seminar)** – 10/20 – *The Shafarevich conjecture for hypersurfaces in abelian varieties*
- **University of Georgia (number theory seminar)** – 9/20 – *New results on prime polynomials*
- **Webinar in Additive Combinatorics** – 8/20 – *Quadratic Bateman-Horn over $\mathbb{F}_q[u]$*

- **University of Chicago (number theory seminar)** – 3/20 – *The Shafarevich conjecture for hypersurfaces in abelian varieties*
- **Chicago - Northwestern - UIC (algebra & geometry seminar)** – 5/20 – *Topological Reconstruction Theorems for Varieties*
- **Stanford University (algebraic geometry seminar)** – 3/20 – *The Shafarevich conjecture for hypersurfaces in abelian varieties*
- **Princeton University (algebraic geometry seminar)** – 2/20 – *Singularities of the moduli space of rational curves on a low-degree hypersurface in projective space*
- **University of California, Berkeley (arithmetic geometry seminar)** – 10/19 – *The sup-norm problem for modular forms over function fields and geometry*
- **MIT - Boston College (joint number theory seminar)** – 9/19 – *The sup-norm problem for modular forms over function fields and geometry*
- **University of Wisconsin Madison (number theory seminar)** – 9/19 – *The sup-norm problem for automorphic forms over function fields and geometry*
- **EPFL (algebraic geometry and number theory seminar** – 3/19 – *The sup-norm problem and geometry*
- **Rutgers (number theory seminar)** – 2/19 – *On the Ramanujan conjecture for automorphic forms over function fields*
- **IST Austria (number theory and algebraic geometry seminar)** – 1/19 – *On the Ramanujan conjecture for automorphic forms over function fields*
- **Princeton University / Institute for Advanced Studies (number theory seminar)** – 11/18 – *The Lucky Logarithmic Derivative*
- **University of Chicago (number theory seminar)** – 11/18 – *The Ramanujan conjecture for automorphic forms over function fields via families*
- **Stony Brook University (algebraic geometry seminar)** – 10/18 – *What circles can do for you*
- **McGill University / Concordia University (Quebec-Vermont number theory seminar)** – 10/18 – *Bringing random matrices back to moments*
- **University of Gothenburg (algebraic geometry and number theory seminar)** – 5/18 – *The circle method and free rational curves on hypersurfaces*
- **University of Amsterdam (arithmetic and algebraic geometry seminar)** – 4/18 – *The cohomology of the moduli spaces of rational curves on hypersurfaces*
- **University of Basel (number theory seminar)** – 4/18 – *The circle method and free rational curves on hypersurfaces*
- **EPFL (algebraic geometry seminar)** – 3/18 – *A geometric version of the circle method*
- **University of Zürich (algebraic geometry seminar)** – 3/18 – *The geometric circle method and the cohomology of moduli spaces of rational curves*
- **University of Bristol (Linfoot number theory seminar)** – 12/17 – *Equidistribution of L-functions over function fields*
- **Université Paris 13 (séminaires de géométrie arithmétique et motivique)** – 11/17 – *Tannakian categories and automorphic forms over function fields*

- **Institut Henri Poincaré (Rencontres de théorie analytique et élémentaire des nombres)** – 9/17 – *Relatives of Progression-Free Sets*
- **University of Michigan (algebraic geometry seminar)** – 11/16 – *On the Unirationality of $\overline{M}_{1,n}$ and Modular Forms*
- **EPFL (algebraic geometry and number theory seminar)** – 10/16 – *On the Unirationality of $\overline{M}_{1,n}$ and Modular Forms*
- **EPFL (combinatorics seminar)** – 10/16 – *Slice Rank and Sunflowers*
- **Stanford University (number theory seminar)** – 4/16 – *Exponential Sums and Modular Forms*
- **Yale University (algebraic geometry seminar)** – 1/16 – *Quasi-random Graphs from Varieties over Finite Fields*
- **University of Michigan (algebraic geometry seminar)** – 12/15 – *Frobenius Arithmetic for Frobenius Geometry*
- **MIT (number theory seminar)** – 11/15 – *The Distribution of the Newton Polygon of a K3 Surface*
- **University of Utah (algebraic geometry seminar)** – 11/15 – *Frobenius Arithmetic for Frobenius Geometry*
- **ETH Zurich (number theory seminar)** – 10/14 – *A Tannakian Category and a Horizontal Equidistribution Conjecture for Exponential Sums*
- **EPFL (analytic number theory seminar)** – 10/14 – *A Tannakian Category and a Horizontal Equidistribution Conjecture for Exponential Sums*
- **Columbia University (mathematical physics seminar)** – 4/21 – *Intersection cohomology complexes of rank one local systems on the configuration spaces of points in $\mathbb{A}^1$*
- **Columbia University (mathematical physics seminar)** – 4/19 – *Polar multiplicities of the nilpotent cone on the moduli space of Higgs bundles*
- **Columbia University (automorphic forms and arithmetic seminar)** – 11/18 – *On the Ramanujan conjecture for automorphic forms over function fields*
- **Columbia University (algebraic geometry seminar)** – 11/18 – *What circles can do for you*
- **ETH Zurich (ITS members' seminar)** – 10/16 – *Cap Sets*
- **Princeton University / Institute for Advanced Studies (number theory seminar)** – 2/16 – *Vanishing Cycles and Bilinear Forms*
- **Institute for Advanced Studies (working group on expander graphs and monodromy groups)** – 5/15 – *Exponential sums and expansion of generalized Paley graphs*
- **Princeton University (working group in Diophantine analysis)** – 5/15 – *Ordinary Primes of Abelian Surfaces*
- **Princeton University (working group in Diophantine analysis)** – 12/14 – *Kloosterman Paths*
- **Princeton University (algebraic geometry preprint seminar)** – 4/14 – *Vanishing Theorems for Constructible Sheaves on Abelian Varieties*
- **Princeton University (junior faculty number theory seminar)** – 11/13 – *Equidistribution of Exponential Sums*
- **Princeton University (graduate student seminar)** – four talks, 2011-2015: *Toric Geometry*, *Belyi's Theorem*, *Λ-Rings*, and *Riemann-Hurwitz*