Nir Elber

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Education

Massachusetts Institute of Technology *Sep. 2025–Present*
Ph.D. in mathematics.

University of California, Berkeley *Aug. 2021–Dec. 2024*
Bachelor of Arts in mathematics. GPA: 4.0/4.0. Graduated with Highest Honors.

Research Experience

University of California, Berkeley SURF *June 2024–Aug. 2024*
Senior thesis. Used group-theoretic methods to understand Frobenius conjugacy classes in disconnected motivic Galois groups of abelian varieties. Also studied some Sato–Tate group computations in Type IV. Advisor: Yunqing Tang.

University of Michigan REU *June 2023–Aug. 2023*
Attached invariants to triples of certain representations of $\mathrm{GL}_2(\mathbb{F}_q)$ and examined properties of these invariants. Advisors: Elad Zehlinger and Jialiang Zou.

University of Michigan REU *May 2022–July 2022*
Used group cohomology to explicitly compute the Tate canonical class. Advisors: Alexander Bertoloni Meli, Patrick Daniels, and Peter Dillery.

Undergraduate Work

Sato–Tate Groups of Generic Superelliptic Curves
Computed the Sato–Tate groups (and related groups) of the Jacobian of the curve $y^9 = x(x-1)(x-\lambda)$ for generic $\lambda \in \mathbb{Q}$ by specializing to computations on special points. In preparation (dfoiler.github.io/handouts/senior-thesis/thesis.pdf).

Intertwining Operators for Siegel Parabolics over Finite Fields
Studied the eigenvalues (and associated combinatorics) of the intertwining operator of the degenerate principal series representations of various even-dimensional classical groups. Preprint (dfoiler.github.io/umich-reu/intertwining.pdf).

Generalized Periodicity in Group Cohomology
Communications in Algebra 52 (6): 2249–68. doi:10.1080/00927872.2023.2296883. Studied a certain generalization of periodic cohomology with computational applications (arXiv:2302.06160).

Explicit Computations of Fundamental Classes
Provided an explicit computation of the local fundamental class in various cases. Gave applications to Artin reciprocity and computations of the Tate canonical class. Preprint (arXiv:2302.06163).

Outreach

Academic Officer *Dec. 2022–Dec. 2024*
Math Undergraduate Student Society (MUSA)
Organized "Math Mondays," a weekly undergraduate seminar. Also Vice President (Dec. 2022–Dec. 2023), in which I ran the bureaucratic side of MUSA, in writing emails, delegating appropriately, and setting up meetings.

Problem Writer *Sept. 2021–Present*
Berkeley Math Tournament (BMT)
Collaborated making problems (writing and solving) for BMT, a high-school math contest. Attended weekly problem-writing meetings and socials. Also graded proof-based questions for the US and China contests.

Talks

The Sato–Tate Conjecture *Feb. 2025*
Automorphic Forms Learning Seminar (Johns Hopkins University)

Random Matrix Theory for Symmetric Matrices *Jan. 2025*
Joint Mathematics Meeting

Tamagawa Numbers *Aug. 2024*
Student Seminar on Automorphic Forms (University of California, Berkeley)

Random Matrix Theory for Symmetric Matrices *Aug. 2024*
Young Mathematicians Conference

Gamma Factors for Representations of General Linear Groups over Finite Fields *Jan. 2024*
Joint Mathematics Meeting

One GL_2, Two GL_2, Red GL_2, Blue GL_2 *July 2023*
Summer Undergraduate Michigan Mathematics Research Conference

Group Laws for Galois Gerbs *Aug. 2022*
Young Mathematicians Conference

Teaching

Facilitator *Spring 2023, Fall 2023, Fall 2024*
MUSA 74
MUSA 74 is a student-led course to ease students through the transition to proof-based mathematics. As facilitator, rewrote course notes, wrote and graded homework problems, managed course logistics, and lectured. Syllabus.

Facilitator *Fall 2023*
MUSA 154
MUSA 154 was a student-lead course discussing topics in Diophantine equations: continued fractions, Pell's equations, Dirichlet's unit theorem, Hensel's lemma, elliptic curves, and coding in SageMath. As facilitator, wrote course notes, wrote and graded homework problems, managed course logistics, and lectured. Syllabus.

Peer Tutor *Mar. 2022–Dec. 2023*
Student Learning Center
Worked one-on-one in drop-in environment for real analysis and abstract algebra and lower-division math as needed. Also co-wrote, organized, and delivered lecture-style content reviews for final exam preparation.

Awards and Fellowships

Levinson Fellowship

NSF Graduate Research Fellowship Program

Dorothea Klumpke Roberts Prize in Mathematics

Coursework

Course numbers beginning with 2 are graduate coursework. Courses are listed thematically. All lecture-style courses have notes at `dfoiler.github.io/notes/XXX/notes.pdf`; only edited notes have been linked.

- 104: Real Analysis (notes)
- 185: Complex Analysis (notes)
- 202A: Topology and Measure Theory (notes)
- 215A: Algebraic Topology
- 214: Smooth Manifolds
- 261A: Lie Groups
- 225A: Model Theory
- 198: Category Theory (student-led)
- 250A: Groups, Rings, and Fields (notes)
- 250B: Commutative Algebra (notes)
- 191: Analytic Number Theory
- 199: Arithmetic Statistics (reading course)
- 199: Modular Forms (reading course)
- 199: Automorphic Forms (reading course)
- 199: Automorphic Forms (seminar)
- 256A: Algebraic Geometry, Schemes
- 256B: Algebraic Geometry, Cohomology
- 199: Étale Cohomology (reading course)
- 254B: Rational Points on Varieties
- 254B: Complex Multiplication of Abelian Varieties