EZRA GUERRERO ALVAREZ

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EDUCATION

Massachusetts Institute of Technology *May 2026*
Bachelor of Science
Major: Mathematics, Major: Physics
Overall GPA: 4.8/5.0

RESEARCH EXPERIENCE

Undergraduate Researcher June 2025–August 2025
MIT Summer Program in Undergraduate Research (Advisor: Lior Alon) *Cambridge, Massachusetts*

- Proved new results on the probability that a random matrix on a graph has simple eigenvalues and nonzero entries for all its eigenvectors.
- Applied tools from spectral geometry, perturbation theory, algebra, and combinatorics.
- Co-authored the research paper *Simple Eigenvalues and Non-vanishing Eigenvectors of the Anderson Model* (arXiv:2512.00278) and delivered a presentation at the end-of-program conference.

Undergraduate Researcher February 2024–May 2025
MIT Department of Mathematics (Advisor: Jonathan Zung) *Cambridge, Massachusetts*

- Studied hyperbolic geometry and 3- and 4-manifold topology, following Martelli's *Introduction to Geometric Topology* and Saveliev's *Lectures on the Topology of 3-manifolds*.
- Explored applications of Morse Theory to Riemannian geometry and Lie groups, following Milnor's *Morse Theory*.
- Authored the expository papers *Constructing Braid Invariants via Representations* and *Applications of Morse Theory to Algebraic Topology*.

Undergraduate Researcher September 2022–December 2022
MIT Department of Mathematics (Advisor: Henry Cohn) *Cambridge, Massachusetts*

- Investigated the Triple Product Property in finite groups as a tool to obtain fast matrix multiplication algorithms.
- Designed and implemented a computational search algorithm in GAP to find trios of subgroups satisfying the Triple Product Property.

Directed Reading Program Participant January 2024
MIT Directed Reading Program *Cambridge, Massachusetts*

- Reviewed Gompf and Stipsicz's *4-manifolds and Kirby Calculus*.
- Applied h-cobordisms, handlebody theory, and the Whitney trick to follow Smale's proof of the Poincaré conjecture in dimension at least 5.
- Gave a presentation on the h-cobordism theorem at the end-of-program symposium.

COURSEWORK

Graduate Courses

- Algebraic Topology I [A], Advanced Algebraic Topology [B], Geometry of Manifolds I [A], Gauge Theory and Related Tools (ongoing).

Advanced Undergraduate Courses

- Introduction to Topology [A], Functions of a Complex Variable [A], Differential Geometry [A], Seminar in Topology [A], Seminar in Geometry [A].

PUBLICATIONS AND PRESENTATIONS

Research Papers

- *Simple Eigenvalues and Non-vanishing Eigenvectors of the Anderson Model*. arXiv:2512.00278

Expository Papers

- *Constructing Braid Invariants via Representations*. December 2024
- *Applications of Morse Theory to Algebraic Topology*. May 2025
- *The Rectifiability Theorem for Varifolds*. May 2025
- *Introduction to Combinatorics Lecture Notes*. August 2025
- *An Overview of the Arf Invariant*. In progress

Presentations

- *The nodal count condition for the Anderson model*, MIT SPUR 2025 Conference. August 2025
- *The h-cobordism theorem*, MIT DRP Symposium. January 2024

TEACHING EXPERIENCE

Mathematics Tutor September 2023–Present
MIT Math Learning Center *Cambridge, Massachusetts*

- Helped undergraduate students with problem sets and conceptual questions.

Undergraduate Assistant — Introduction to Topology Spring 2024, Spring 2025, Fall 2025
MIT Department of Mathematics *Cambridge, Massachusetts*

- Improved student comprehension by answering questions in weekly office hours.
- Drafted solutions for weekly problem sets.
- Graded problem sets and exams.

PRIMES Circle Mentor February 2025–May 2025
Menezes Challenge PRIMES Circle *Cambridge, Massachusetts*

- Assigned and discussed weekly readings and problem sets using Adam's *The Knot Book*.
- Mentored students as they drafted their final paper and presentation.

Undergraduate Assistant — Differential Geometry September 2024–December 2024
MIT Department of Mathematics *Cambridge, Massachusetts*

- Offered one-on-one help with course material during weekly office hours.
- Graded problem sets and midterm exams.

Teaching Assistant January 2025
MISTI Global Teaching Labs, Spain *Madrid, Spain*

- Assisted high school teachers with materials for their classes.

SKILLS

Languages	French, Spanish
Typesetting	LaTeX
Programming	Python, Julia, MATLAB, Mathematica, GAP