Matthew Gherman

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Citizenship: United States of America
Date of Birth: February 9, 1995

EDUCATION

UNIVERSITY OF CALIFORNIA, LOS ANGELES — Los Angeles, CA
Department of Mathematics
Cumulative GPA: 3.89/4.00
Doctor of Philosophy in Mathematics — June 2023
Master of Arts in Mathematics — June 2019

DUKE UNIVERSITY — Durham, NC
Trinity College of Arts and Sciences
Cumulative GPA: 3.95/4.00, GPA for math courses: 3.94/4.00
Bachelor of Science in Mathematics, *magna cum laude* — May 2017
Dean's List with Distinction 2013-2014, Dean's List 2015-2016

BUDAPEST SEMESTERS IN MATHEMATICS — Budapest, Hungary
Graduated with Honors from the Budapest Semesters in Mathematics in Fall 2015

TEACHING EXPERIENCE

CALIFORNIA INSTITUTE OF TECHNOLOGY — Pasadena, CA
Hearst Postdoctoral Teaching Fellow in Mathematics, California Institute of Technology — September 2023-present
- Instructor for group theory, graph theory, and proof-based calculus

UNIVERSITY OF CALIFORNIA, LOS ANGELES — Los Angeles, CA
Graduate Student Instructor, UCLA Department of Mathematics — March-September 2022
- In-person lead instructor for Math 110B - Group Theory to mathematics majors
- Online lead instructor for summer session Math 115A - Linear Algebra to prospective mathematics majors

UNIVERSITY OF CALIFORNIA, LOS ANGELES — Los Angeles, CA
Teaching Assistant, UCLA Department of Mathematics — September 2017-March 2022
- Led weekly discussions, held office hours, graded midterms and sometimes homework
- Courses include lower and upper division linear algebra, differential equations, calculus for life sciences, upper division and graduate algebra

TA/POSTDOC TRAINING

MAA SOUTHERN CALIFORNIA-NEVADA SECTION NExT LIAISON — October 2024-present
- Member of the MAA SoCal-Nevada Section board
- Organizes teaching pedagogy workshops at the MAA SoCal regional meetings

ORGANIZER OF CALTECH "CONVERSATIONS ABOUT MATH TEACHING" — Pasadena, CA
Hearst Postdoctoral Teaching Fellow in Mathematics, California Institute of Technology — March 2024-present
- Coordinates biweekly, interactive math pedagogy seminars for undergraduates, grads, postdocs, and faculty
- Topics include active learning, backward course design, inclusive teaching practices, and AI in education

CALTECH CAMPUS-WIDE TA TRAINING FACILITATOR — Pasadena, CA
Hearst Postdoctoral Teaching Fellow in Mathematics, California Institute of Technology — September 2024
- Gave an interactive talk on the role of the TA
- Led feedback session for new mathematics TAs

PHYSICS, MATHEMATICS, AND ASTRONOMY DIVISION TA TRAINING — Pasadena, CA
Hearst Postdoctoral Teaching Fellow in Mathematics, California Institute of Technology — September 2023 and 2024
- Gave an interactive talk on the role of the TA
- Member of a teaching panel
- Led feedback session for new mathematics TAs

CALTECH PHYSICS, MATHEMATICS, AND ASTRONOMY DIVISION WINTER TEACHING WORKSHOP
Hearst Postdoctoral Teaching Fellow in Mathematics, California Institute of Technology — January 2024
- Organized and led a workshop about learning objectives for Caltech TAs in physics, math, and astronomy

UNIVERSITY OF CALIFORNIA, LOS ANGELES — Los Angeles, CA
Teaching Assistant Consultant, UCLA Department of Mathematics — September-December 2022
- Administered the TA training seminar for incoming graduate students
- Attended pedagogy seminars to reinforce learning objectives and active teaching techniques

UNDERGRADUATE AND HIGH SCHOOL RESEARCH

SUMMER UNDERGRADUATE RESEARCH FELLOWSHIP 2024
Hearst Postdoctoral Teaching Fellow in Mathematics, California Institute of Technology January 2024-present

- Supervises a rising sophomore at Caltech
- Proved results about negligible cohomology of finite groups over fields of characteristic p, extended results about eventually negligible to integer and mod n coefficients, and identified a relationship between the image of the Bockstein homomorphism and negligible classes
- Currently computing the mod p negligible cohomology of cyclic groups over rational numbers
- Student-Faculty Programs Fall Seminar Day 2024 talk
- Southern California Conference for Undergraduate Research 2024 talk

FIRST-YEAR SUCCESS RESEARCH INSTITUTE
Hearst Postdoctoral Teaching Fellow in Mathematics, California Institute of Technology June 2024-present

- Supervises a group of three incoming freshman at Caltech
- Proved Graham's Conjecture for the lexicographical and co-normal products of two graphs
- Determined a sharp upper bound for the pebbling number of a rooted product of two graphs in terms of their respective pebbling numbers and provided an example to show that Graham's Conjecture does not always hold for the rooted product of two graphs
- Currently improving the upper bound on the pebbling number of the co-normal and rooted products of two graphs
- First-year Success Research Institute lightning talk and poster presentation
- One student presented the poster at the MAA Socal-Nevada Spring 2025 Section Meeting

SUMMER RESEARCH CONNECTION
Hearst Postdoctoral Teaching Fellow in Mathematics, California Institute of Technology June-August 2024

- Supervised two advanced high schoolers from Pasadena Unified School District
- Determined optimal pebbling number of maximal lobster trees by computing optimal 4-pebbling number of paths
- Summer Research Connection talk

UNDERGRADUATE RESEARCH PROJECT ABOUT NEGLIGIBLE COHOMOLOGY
Hearst Postdoctoral Teaching Fellow in Mathematics, California Institute of Technology December 2023-present

- Supervises three Caltech freshman who used the p-cohomology package in SageMath to compute minimal generators for the eventually negligible ideal in the mod 2 cohomology of finite 2-groups based on an original detection method similar to Quillen-Venkov
- Caltech Morgan Ward Prize 2024 recipients

UNDERGRADUATE RESEARCH PROJECT ABOUT OPTIMAL GRAPH PEBBLING
Hearst Postdoctoral Teaching Fellow in Mathematics, California Institute of Technology June 2024-present

- Supervises one USC senior
- Computed optimal pebbling number of lollipop and tadpole graphs, verified optimal pebbling number of spider graphs.
- Presented a poster at the MAA Socal-Nevada Spring 2025 Section Meeting

UNDERGRADUATE RESEARCH PROJECT ABOUT FRACTIONAL GRAPH PEBBLING
Hearst Postdoctoral Teaching Fellow in Mathematics, California Institute of Technology November 2023-present

- Supervises one Caltech sophomore
- Computed the fractional pebbling number of vertex-transitive graphs, claw graphs, and complete m-ary trees for $m > 2$ in order to improve known lower bounds on the optimal pebbling number of those graphs
- Computing the fractional pebbling number of path graphs, complete bipartite graphs, and binary trees

UNIVERSITY OF CALIFORNIA, LOS ANGELES Los Angeles, CA
Directed Reading Program, Department of Mathematics February-June 2022

- Mentored an undergraduate mathematics major for two quarters in algebraic topology

MATH CIRCLES

CALTECH MATH CIRCLE Pasadena, CA
Lead Instructor, California Institute of Technology September 2023-present

- Teaches three weekly interactive, extracurricular math lessons to roughly 4th graders, 6th graders, and 8th graders
- Creates original content about graph theory, topology, game theory, probability, and logic puzzles

SANTA MONICA OPULENT MATH CIRCLE Santa Monica, CA
Lead Instructor, Museum of Flying February 2025-present

- Teaches two monthly interactive, extracurricular math lessons to passionate elementary and middle schoolers

TUCSON MATH CIRCLE Online
Instructor, UCLA Department of Mathematics October 2023-April 2024

- Led weekly interactive math lessons using Miro and Zoom to passionate elementary and middle schoolers

UCLA OLGA RADKO ENDOWED MATH CIRCLE Los Angeles, CA
Lead Instructor, UCLA Department of Mathematics September 2018-June 2022
Instructor, UCLA Department of Mathematics September 2017-June 2018

- Taught passionate, accelerated middle and high schoolers advanced mathematics
- Led and created content for weekly meetings

OUTREACH

EXPLORE CALTECH BY THE CALTECH POSTDOC ASSOCIATION Pasadena, CA
Organizer, California Institute of Technology – Bechtel Mall September 28, 2024

- Campus-wide STEM outreach event with ~800 attendees from the Pasadena community, 15 interactive booths, 6 TED-style talks, 8 ask-a-scientist panelists, tours of PST ART installations
- https://cpa.caltech.edu/outreach/past-events/explore-caltech

CALTECH STUDENT-FACULTY PROGRAMS FALL SEMINAR DAY 2024 Pasadena, CA
Summer Undergraduate Research Fellowship volunteer poster judge October 19, 2024

CATCH UP AND SNEAK AHEAD Pasadena, CA
Lead Instructor and Organizer, Pasadena Public Library – La Pintoresca Branch Library Summer 2024

- Four summer sessions of hands-on math activities for elementary and middle schoolers including three-utilities problem, coloring planar graphs, building polyhedra out of toothpicks, and cutting Möbius strips

STEAM SUMMER EXPERIENCE Pasadena, CA
Volunteer instructor, California Institute of Technology July 1-19, 2024

- Three-week summer camp for elementary and middle schoolers filled with hands-on activities and learning opportunities in STEAM

PCC UPWARD BOUND MATH AND SCIENCES Pasadena, CA
Volunteer Instructor, Pasadena City College July 15, 2024

- Upward Bound is one of the four federally-funded TRIO programs hosted at Pasadena City College that strives to give students from first generation, low-income backgrounds the tools and the opportunity to attend college
- Led an interactive session about Euler circuits and Hamiltonian paths in graphs

RISE TUTORING Pasadena, CA
Volunteer Tutor, John Muir High School Early College Magnet January 2024-present

- Led weekly drop-in tutoring sessions for middle and high schoolers

AWARDS AND COMMITTEES

CALTECH POSTDOC ASSOCIATION Pasadena, CA
Treasurer and Outreach Chair Summer 2024-present

- Organizer of Explore Caltech, a campus-wide STEM outreach event
- Organizer of STEM for Families, a recurring series of interactive STEM activities for local kids and their families

CALTECH ASCIT TEACHING AWARD 2024 Pasadena, CA
California Institute of Technology June 2024

- Associated Students of the California Institute of Technology Teaching Award is completely determined by Caltech students for an exceptional professor or instructor

EQUITY, DIVERSITY, AND INCLUSION COMMITTEE Los Angeles, CA
UCLA Department of Mathematics Fall 2022-June 2023

- Coordinated initiatives related to equity, diversity, and inclusion
- Increased transparency of departmental operations

LIGGETT FELLOW AWARD 2022 Los Angeles, CA
UCLA Department of Mathematics June 2022

- For excellence in teaching and its support

PROFESSIONAL DEVELOPMENT

MAA PROJECT NExT (NEW EXPERIENCES IN TEACHING)
Green '23 cohort Summer 2023-Summer 2024

- Participated in workshops at MathFest 2023, JMM 2024, and MathFest 2024 about improving teaching and learning of mathematics, engaging in research, scholarship, and professional activities, and finding service opportunities

POSTDOC PRE-FACULTY PEDAGOGY PREPARATION PROGRAM (5P) Pasadena, CA
Caltech Center for Teaching, Learning, and Outreach (CTLO) Fall 2024-present

- Pedagogy: Completed Principles of University Teaching and Learning in STEM
- Practice: Wrote a reflection about Associate Director of the CTLO observation of and feedback about active problem-solving session in calculus course
- Ongoing project, professional planning, and portfolio

LA JOYFUL MATH SYMPOSIUM 2024 Pasadena, CA
American Institute of Mathematics workshop November 16, 2024

- Set a goal that each student in the Los Angeles area should have 6 joyful math experiences per year, identified hurdles toward achieving the goal, and broke into small groups to brainstorm solutions
- Developed techniques for changing the public perception of mathematics including a pitch for a social media campaign

CULTURALLY RESPONSIVE AND COGNITIVELY DEMANDING INFORMAL MATHEMATICS TASKS
American Institute of Mathematics workshop June 30-July 2, 2024

- Created a framework for designing culturally responsive, cognitively demanding, informal mathematical investigations
- Generated examples of high-quality, culturally responsive mathematics activities for out-of-school programs that engage culturally diverse learners and their teachers
- Built a long-term partnership between formal and informal sectors of the mathematics education ecosystem, centered around a shared commitment to equitable and culturally responsive mathematics instruction

CRITICAL ISSUES IN MATHEMATICS EDUCATION (CIME) 2024 Oakland, CA
Simons Laufer Mathematical Sciences Institute April 4-5, 2024

- Bringing Innovation to Scale: Teaching Focused Faculty as Change Agents
- Teaching-focused faculty from across the country discussed a host of issues facing departments including course coordination, addressing long-standing DEI issues, replacing developmental math sequences with corequisite supports, using alternative grading methods at scale, leading departmental change efforts, and elevating teaching-focused faculty

CALTECH FACULTY SUMMER SHORT COURSE ON COURSE DESIGN Pasadena, CA
California Institute of Technology Summer 2023

- Intensive two-day workshop on course design
- Topics include course learning objectives, creating assignments and assessments, using technology tools like Canvas and Gradescope, course grading models, and pedagogical best practices

PUBLICATIONS

Gherman, M. and Merkurjev, A. Krull dimension of the negligible quotient in mod p cohomology of a finite group. *Journal of Pure and Applied Algebra*, vol. 228 (2023).

- For a finite group G, a G-module M and a field F, an element $u \in H^d(G, M)$ is negligible over F if for each field extension L/F and every group homomorphism $Gal(L^{sep}/L) \to G$, u belongs to the kernel of the induced homomorphism $H^d(G, M) \to H^d(L, M)$. For p a prime and a trivial G-action on the coefficients, the negligible elements in the cohomology ring $H^*(G, Z/pZ)$ form an ideal. We show that when p is odd or $p = 2$ and either $|G|$ is odd or F is not formally real, the Krull dimension of the quotient of mod p cohomology by the negligible ideal is 0. However, when $p = 2$, $|G|$ is even, and F is formally real, the Krull dimension of the quotient of mod 2 cohomology of a finite 2 -group by the negligible ideal is 1. We further compute the generators of the negligible ideal in mod p cohomology of elementary abelian p-groups.

Gherman, M. and Merkurjev, A. Negligible degree two cohomology of finite groups. *Journal of Algebra*, vol. 611 (2022) 82-93.

- For a finite group G, a G-module M and a field F, an element $u \in H^d(G, M)$ is negligible over F if for each field extension L/F and every group homomorphism $Gal(L^{sep}/L) \to G$, u belongs to the kernel of the induced homomorphism $H^d(G, M) \to H^d(L, M)$. We determine the group of negligible elements in $H^2(G, M)$ for every abelian group M with trivial G-action.

TALKS

SPEAKER AT MAA SOCAL-NEVADA SPRING 2025 SECTION MEETING March 29, 2025

- Title: "Section NExT Spring 2025: Embodied Mathematics"
- Abstract: The audience participates in an embodied activity about modular arithmetic. We discuss the benefits of embodied activities on student learning and design principles for such activities. The participants will break into teams and outline a potential embodied activity for a topic in one of their classes.

SPEAKER IN ANTC SEMINAR OF THE CLAREMONT COLLEGES April 30, 2024

- Spoke to undergraduates, graduate students, postdocs and faculty in the Algebra/Number Theory/Combinatorics Seminar of the Claremont Colleges
- Title: "Negligible Cohomology"
- Abstract: We discuss the motivation and key definitions for negligible cohomology, culminating in the feasibility of approximating Galois cohomology by finite group cohomology

SPEAKER AT MATHEMATICS EDUCATOR APPRECIATION DAY (MEAD) January 27, 2024

- Title: "Math Circles: Elevating Student Engagement and Mathematical Enjoyment Outside the Classroom"
- Co-speakers: John Peca-Medlin (University of Arizona), Christina Duron (Pepperdine University)
- Abstract: We outline our experience using Miro in the Tucson Math Circle and provide an overview of the functionality and potential uses of Miro and Geogebra in math activities

SPEAKER AT CALTECH MATH MEET 2025 January 25, 2025

- Caltech Math Meet is an annual high school math competition hosted by Caltech
- Spoke to students, parents, and teachers at the Caltech Math Meet

- Title: “Ramsey Theory”
- Abstract: We discuss early results and definition in Ramsey Theory, recent progress in computing Ramsey numbers, and the application of Ramsey Theory to the Happy Ending Problem

SPEAKER AND VOLUNTEER AT CALTECH MATH MEET 2024 January 27, 2024

- Caltech Math Meet is an annual high school math competition hosted by Caltech
- Proctored the free response section and helped set up rooms
- Spoke to students, parents, and teachers at the Caltech Math Meet
- Title: “The Fundamental Group”
- Abstract: We discuss key definitions and intuition behind the fundamental group, culminating in covering spaces and Galois correspondence