

Adam Boocher

Positions

September 2023 - **University of San Diego**
Associate Professor
Present

July 2018 - **University of San Diego**
August 2023 Assistant Professor

July 2016 - **University of Utah**
June 2018 Don Tucker Postdoctoral Research Assistant Professor

July 2015 - **University of Utah**
July 2016 Research Assistant Professor

Jan 2014 - **University of Edinburgh**
July 2015 Postdoctoral Researcher

Interests

Commutative Algebra, Computational Algebraic Geometry, Combinatorics

Education

Ph.D. **University of California, Berkeley**, *Fall 2013*
Mathematics Advisor: David Eisenbud
Thesis: Superflatness

B.S. Honors **University of Notre Dame**, *Spring 2008*
Mathematics Summa Cum Laude
Phi Beta Kappa

Awards, Grants, and Fellowships

American Mathematical Society - Simons PUI Faculty Grant (2024 - 2027 to support travel for syzygy research)

Distinguished Paper Prize for paper published in 2021 from Collectanea Math (awarded Fall 2022)

University of San Diego Faculty Research Grant (2025-2026), (2024-2025), (2023-2024), (2022-2023), (2021-2022), (2020-2021)

University of San Diego Teaching and Learning Grant (2020)

Project NExT Fellow (2019)

Don H. Tucker Postdoctoral Fellowship (2016)

Professor of the Year Award (U. of Utah Greek Fraternity and Sorority Councils 2016)

NSF Conference Grant for Macaulay2 Meeting in Salt Lake City (PI) (2015)

Distinguished Graduate Student Instructor Award (2012)

NSF Graduate Research Fellowship (2008)

Barry M. Goldwater Scholarship (2006)

G.E. Prize for Honors Mathematics Majors (2008)

Kolettis Award in Mathematics (2008)

Poster Prize at Joint Math Meetings (2008)

Robert Balles Mathematics Prize (2007)

Aumann Prize in Mathematics (2005)

Publications

[17]. **The Software Package SpectralSequences.** *Submitted.* (with N. Grieve and E. Grifo)

- [16]. **On the Rank of Multigraded Differential Modules 2024** *Mich. J. Math.* (with J. Devries)
- [15]. **Lower Bounds of Betti Numbers.** *Commutative Algebra. Springer, Cham, 2021. 77-111* (Volume in honor of David Eisenbud's 75th Birthday). (with E. Grifo)
- [14]. **Techniques for predicting and avoiding unintentional biplanar movements during iliosacral screw placement.** *Injury (medical journal)* 2021. (with Ajinkya Rane, Bennet Butler, Robert O'Toole)
- [13]. **Large Lower Bounds for the Betti Numbers of Graded Modules with Low Regularity.** *Collectanea Mathematica (2021) 72, 393-410.* with D. Wigglesworth)
- [12]. **Lower Bounds for Betti Numbers of Monomial Ideals.** *Journal of Algebra (2018) 508, 445-460.* (with J. Seiner)
- [11]. **Koszul Algebras Defined by Three Relations.** *Springer INdAM Volume in honor of Winfried Bruns (2017).* (with H. Hassanzadeh and S. Iyengar)
- [10]. **On the Growth of Deviations.** *Proc. Amer. Math. Soc. 144 (2016), no. 12* (with A. D'Alì, E. Grifo, J. Montaña, A. Sammartano)
- [9]. **Edge Ideals and DG Algebra Resolutions.** *Le Matematiche. 70 (2015), no. 1, 215-238* (with A. D'Alì, E. Grifo, J. Montaña, A. Sammartano)
- [8]. **The Closure of a Linear Space in a Product of Lines.** *J. Alg. Comb 43 (1), 199-235, 2016.* (with F. Ardila)
- [7]. **Robust Graph Ideals.** *Ann. Comb. 19 (4), 641-660, 2015* (with B. Brown, T. Duff, L. Lyman, T. Murayama, A. Nesky, K. Schaefer)
- [6]. **Robust Toric Ideals.** *J. Symbolic Comput. 68, 2015, part 1, 254-264.* (with E. Robeva)
- [5]. **Free Resolutions and Sparse Determinantal Ideals.** *Math. Res. Lett. 19 (2012), no. 4, pp. 805-821.*
- [4]. **Dimensions of Formal Fibers of Height One Prime Ideals.** *Comm. Algebra 38 (2010), no. 1, pp. 233-253.* (with M. Daub, S. Loepp)
- [3]. **Formal Fibers of Unique Factorization Domains.** *Canad. J. Math 62 (2010), no. 4, pp. 721-736.* (with M. Daub, R. Johnson, H. Lindo, S. Loepp, P. Woodard)
- [2]. **Sampling Lissajous and Fourier Knots.** *Experiment. Math. 18 (2009), no. 4, pp. 481-497.* (with J. Daigle, J. Hoste, W. Zheng)
- [1]. **On generators of bounded ratios of minors for totally positive matrices.** *Linear Algebra Appl. 428 (2008) pp. 1664-1684* (with B. Froehle)

Undergraduate Research Supervised

University of San Diego Summer REU

Noah Huang and Harrison Wolf (U. San Diego)

From Classical Commutative Algebra to Diophantine Equations (paper in preparation)

University of San Diego Honors Thesis

Valerie Gilbert (U. San Diego)

Senior Honors Thesis: An Exploration of the Betti Numbers of Modules, Particularly of Codimension 5, Over a Polynomial Ring

University of Utah Honors Thesis

Noble Williamson (U. Utah)

Senior Honors Thesis: The Herzog-Kühl Equations

University of Utah Summer REUs

• Sarah Melancon (U. Utah)

Topics in Commutative Algebra

• Jimmy Seiner (U. Michigan)

Paper "Lower Bounds for Betti Numbers of Monomial Ideals" Published in J. Algebra. Jimmy was invited to the National Joint Mathematics Meeting (2019) to give a talk about this research.

Berkeley RTG Summer Undergraduate Research Program (Summer 2013)

Students Advised: Bryan Brown, Tim Duff, Laura Lyman, Takumi Murayama, Amy Nesky, Karl Schaefer
All students presented at joint conference with Stanford's summer program
Research paper "Robust Graph Ideals" published in Annals of Combinatorics.
Tim Duff and Karl Schaefer won a "Best Poster Prize" at the 2014 Joint Meeting
REU Organizer: Algebraic Geometry Group at Notre Dame REU (Summer 2008)
Students Advised: Josh Mollner, Kaitlyn Moran, Emma Whitten
Josh and Emma presented at MathFest in 2008.
Undergraduate Reading Course Instructor (Spring 2007)
Designed algebraic geometry course material accessible to sophomore math majors

Service, Outreach, and Other Professional Activities

Service to the USD Math Department

Math 262 Topics and Standards Committee Organizer (2025 - present)
Clare Friedman Scholarship Selection Committee (2023-2024)
Member of faculty review committee for E. Cilli-Turner's 4th Year Review (2023-2024)
Putnam Exam Local Organizer (2021, 2022, 2023)
Co-organizer of the Faculty Seminar (2022-2023, 2023-2024)
Chair of a departmental committee on our gateway course offerings (Math 260 / 262) (2021)
Advisor for the Mathematics Club MathEx (2019 - 2024)
Member of departmental ARRT committee to revise our ARRT document (2020-2021)
I prepared assessment reports for two learning outcomes of the math major (2020)
I assisted in drafting the department's proposal for an advanced writing (CADW) flag for Math 360 with J. Friedman and L. Pruski (2020)
Co-organizer (with A. Ruiz) an information meeting about summer opportunities for students in mathematics (2019)
Member of faculty review committee for M. Shulman's Tenure Review. (2019-2020)
Member of the Calculus Committee in the mathematics department (2019)
Member of the Calculus Working Group (Fall 2019)

Service and Support of University of San Diego

University Research Council Member (2023-2024)
Summer math mentor for AnchorSTEM program (2022)
Goldwater Scholarship Nominating Committee Member (2021 - 2024)
USD Health Sciences Student Evaluation Committee (2021 - present)
Member of advisory council for both the ITPP and Liberal Studies programs. (2018 - 2024)
CEE Faculty Facilitator for the Math Department (2020)
PI on an NSF grant proposal with 5 other USD faculty in Math, Biology and Environmental and Ocean Sciences: "Anchoring Student Success in STEM through Meaningful Mathematical Connections to the Life and Environmental Sciences."
Teller for the Academic Assembly for all of the meetings (2018-2019)
I was a faculty presenter at SOCSTEM/M Research Night. (2019)

Service to Broader Mathematics Community

Head of TAs for Notre Dame / SLMath Workshop - Commutative Algebra and its Interaction with Algebraic Geometry (Summer 2023)
Co-organizer of AMS Special Session on Commutative Algebra, U. of Utah (Fall 2022)
Webmaster for the google drive repository for the Silver '19 cohort of Project NExT (2019-present)
Outreach: Post Tiktok math videos for students available at Tiktok account rx_math.
Referee: Proposal reviewer for International Centre for Mathematical Sciences (Scotland), and for the journals: Algebra and Number Theory, J. Algebra, Proc. AMS, J. Comb. Theory Ser. A, J. Comm. Algebra, J. Pure and Applied Algebra, J. Symbolic Computation, Michigan Math. J., Springer INdAM.
Judge for Math Association of America undergraduate presentations at the Joint Mathematical Meetings (2020)

Participant in the CU Boulder study “What Difference Does Early-Career Faculty Development Make?”
 Judge for Math Association of America undergraduate presentations at Mathfest (2019)
 Co-organizer the *Undergraduate Workshop in Commutative Algebra at the University of Notre Dame* giving 4 lectures and problems sessions to 27 students from various institutions in the United States and Mexico, Notre Dame, (Summer 2019 with Sonja Mapes and Claudiu Raicu)
 Instructor of Mini Course on Gröbner Bases at the University of Utah’s Workshop on Commutative Algebra for Graduate Students (Summer 2018)
 Co-Facilitator of the U. Utah TA Training Program for incoming graduate students (Summer 2017)
 Teaching Assistant for MSRI International Summer Graduate School - Okinawa Japan (Summer 2017)
 Organizer - Summer workshop for High School Math Teachers, U. of Utah (Summer 2017)
 PI and Co-organizer of the *Macaulay2 Development Workshop*, U. of Utah (Spring 2016)
 Co-organizer of AMS Special Session on Commutative Algebra, U. of Utah (Spring 2016)
 Co-organizer of GLEN Seminar, U. of Glasgow (Spring 2015)
 Co-organizer of the UK Commutative Algebra Seminar (2014 - 2015)
 Author/Contributor to **SpectralSequences** package for *Macaulay2*
 UC Berkeley Math Department Faculty Hiring Subcommittee Graduate Student Member (Spring 2011)
 Co-organizer of the Berkeley Graduate Student Mentoring Program (2009-2011)
 Math Graduate Student Association Officer (2009 - 2012)
 Graduate Student Representative to the University Committee for Course Instruction (COCI) (2008-2009)
 Organizer of first year student algebraic geometry seminar - UC Berkeley (2008 - 2009)
 Teaching assistant for Notre Dame research experience for high school teachers (Summer 2008)
 Co-organizer of the conference: Undergraduate Work in Mathematics, Notre Dame, (September 2007)
 Proofreader, Greek Celestial Mechanics Manuscript (2006-2007)

Invited Talks

AMS Sectional Meeting, San Luis Obispo (May 2025)
U. Notre Dame Algebraic Geometry and Commutative Algebra Seminar (January 2025)
UC Berkeley Commutative Algebra Seminar (December 2024)
AG at PUI Seminar, Virtual nationwide seminar (September 2024)
University of Utah Commutative Algebra Seminar, Salt Lake City, (August 2024)
AMS Joint Mathematical Meetings, San Francisco (Winter 2024)
Banff International Research Station Workshop on Rank Conjectures in Algebraic Topology and Commutative Algebra (Virtual Participant, short presentation), (Fall 2022)
AMS Sectional Meeting, Purdue (Virtual), (Spring 2022)
AMS Sectional Meeting, San Francisco (Virtual), (Spring 2021)
The Fellowship of the Ring (National Commutative Algebra Seminar), (Virtual), (Spring 2021)
UC Riverside Commutative Algebra Seminar, Riverside (Virtual), (Fall 2020)
AMS Sectional Meeting, El Paso (Virtual), (Fall 2020)
CAZoom, (Virtual National Conference), (Spring 2020)
UC Irvine Number Theory Seminar, Irvine, (Fall 2019)
Undergraduate Workshop in Commutative Algebra at the University of Notre Dame (4 lectures), Notre Dame, (Summer 2019)
University of Utah Commutative Algebra Seminar, Salt Lake City, (Spring 2019)
Joint Mathematics Meetings, Baltimore (Winter 2019)
AMS Sectional Meeting, Ann Arbor (Fall 2018)
University of San Diego Faculty Seminar, San Diego, (Fall 2018)
Joint Mathematics Meetings, San Diego (Winter 2018)
Structures on Free Resolutions Conference, Lubbock (Fall 2017)
UC Berkeley Commutative Algebra Seminar (Fall 2017)
University of Edinburgh EDGE Seminar (Fall 2017)

Park City Mathematics Institute - Program for High School Students (Summer 2017)
 Westminster College Senior Seminar (Spring 2017)
 Colorado State FRAGMENT Seminar (Spring 2017)
 Colorado State SPLINTER Seminar (Spring 2017)
 University of Wisconsin, Madison (Fall 2016)
Midwest Commutative Algebra and Algebraic Geometry Conference, Notre Dame (Spring 2016)
 Algebra and Geometry Seminar, Caltech (Spring 2016)
 Westminster College Guest Lecture (Spring 2016)
 University of Utah Algebraic Geometry Seminar (Fall 2015)
AMS Sectional Meeting California State University, Fullerton (Fall 2015)
 University of Notre Dame Algebra Seminar (Fall 2015)
AMS Sectional Meeting Loyola University, Chicago (Fall 2015)
 University of Utah Commutative Algebra Seminar (Fall 2015)
British Indian Mathematical Seminar; Chennai, India (Winter 2015)
 Queen Mary University, London (Fall 2014)
MOCCA Conference Levico Terme, Italy (Summer 2014)
 University of Warwick Algebraic Geometry Seminar (Spring 2014)
 University of Edinburgh EDGE Seminar (Winter 2014)
 University of Kentucky Algebra Seminar (Winter 2014)
Joint Math Meetings Baltimore (Winter 2014)
AMS Sectional Meeting University of California Riverside (Fall 2013)
 San Francisco State University (Fall 2013)
 UC Berkeley Commutative Algebra Seminar (Fall 2013)
SUMR Reunion Conference honoring Frank Connolly, University of Notre Dame (Spring 2013)
Joint Math Meeting, San Diego (Winter 2013)
 UC Berkeley Commutative Algebra Seminar (Fall 2012)
Syzgies Conference, Cornell University, NY (Fall 2012)
 MSRI Commutative Algebra Seminar (Fall 2012)
 University of Michigan Commutative Algebra Seminar (Fall 2012)
 University of Notre Dame Algebraic Geometry Seminar (Fall 2012)
 UC Berkeley Computational Algebraic Geometry Seminar (Spring 2012)
 UC Berkeley Commutative Algebra Seminar (Fall 2011)
 MONICA Conference Castro-Urdiales, Spain (Summer 2011)
 Purdue U. Comm. Algebra Seminar (Fall 2007)

Selected Conferences Attended

(★ denotes conferences where I presented)

MSRI/SLMath Introductory Workshop in Commutative Algebra (Winter 2024)
 ★ *AMS Joint Mathematical Meetings*, San Francisco (Winter 2024)
 Notre Dame Center for Math / SLMATH Workshop - Commutative Algebra and its Interaction with Algebraic Geometry, Notre Dame, (Summer 2023)
AMS Sectional Meeting, Salt Lake City (Fall 2022)
 ★ *Banff International Research Station Workshop on Rank Conjectures in Algebraic Topology and Commutative Algebra*, (Virtual Participant) (Fall 2022)
 ★ *AMS Sectional Meeting*, Purdue (Virtual) (Spring 2022)
 ★ *AMS Sectional Meeting*, San Francisco State (Virtual) (Spring 2021)
 ★ *AMS Sectional Meeting*, El Paso (Fall 2020)
Project NExT Professional Development Workshop, (Virtual) (Summer 2020)
Mastery-Based Grading Conference, (Virtual) (Summer 2020)
Joint Mathematics Meetings, Denver (Winter 2020)

Mathfest, Cincinnati (Summer 2019)
Project NExT Professional Development Workshop, Cincinnati (Summer 2019)
Conference on Commutative Algebra and its Interaction with Algebraic Geometry In Honor of Bernd Ulrich, Notre Dame (Summer 2019)
 ★ *Undergraduate Workshop in Commutative Algebra at the University of Notre Dame (4 lectures)*, Notre Dame, (Summer 2019)
 ★ *Joint Mathematics Meetings*, Baltimore (Winter 2019)
 ★ *AMS Sectional Meeting*, Ann Arbor (Fall 2018)
Banff International Research Station Workshop on Syzygies, San Diego (Summer 2018)
 ★ *Joint Mathematics Meetings*, San Diego (Winter 2018)
 ★ *Structures on Free Resolutions Conference*, Lubbock (Fall 2017)
Bay Area Discrete Math Day, Moraga, CA (Fall 2017)
Commutative Algebra Plus (CA+), Minneapolis (Fall 2017)
Stillman's Conjecture and other Progress on Free Resolutions Berkeley (Summer 2017)
 ★ *Summer Graduate School - Commutative Algebra and Related Topics*; Okinawa, Japan (Summer 2017)
A View Towards Algebraic Geometry, in honor of David Eisenbud's birthday; Martha's Vineyard (Spring 2017)
Homological Conjectures; Chicago (Fall 2016)
RUME with a View; Norman (Fall 2016)
Commutative Algebra and Its Interactions with Algebraic Geometry (in honor of Craig Huneke's Birthday), Michigan (Summer 2016)
 ★ *Midwest Commutative Algebra and Algebraic Geometry Conference*; Notre Dame (Spring 2016)
Joint Math Meetings; Seattle (Winter 2016)
 ★ *AMS Sectional Meeting*; Loyola University, Chicago (Fall 2015)
 ★ *AMS Sectional Meeting*; California State University, Fullerton (Fall 2015)
AMS Algebraic Geometry Summer Institute; Salt Lake City, Utah (Summer 2015)
Syzygies and Applications in honor of Frank Schreyer; Saarbrücken, Germany (Summer 2015)
MRC - Math Research Communities; Commutative Algebra. Snowbird, Utah (Summer 2015)
GLEN; Glasgow, Scotland (Spring 2015)
Let's Matroid; Neuchâtel, Switzerland (Spring 2015)
 ★ *British Indian Mathematical Seminar*; Chennai, India (Winter 2015)
Commutative Algebra in UK Seminar; Sheffield, UK (Fall 2015)
BrAG; Warwick, UK (Fall 2014)
 ★ *MOCCA*; Levico Terme, Italy (Summer 2014)
Algebraic Geometry in Seattle; Washington (Summer 2014)
 ★ *PRAGMATIC*; Catania, (Summer 2014)
 ★ *Joint Math Meetings*; Baltimore, (Winter 2014)
 ★ *Western Algebraic Geometry Seminar (WAGS)*; San Diego (Fall 2013)
 ★ *AMS Sectional Meeting*; University of California, Riverside, (Fall 2013)
MEGA; Goethe-Universität, Frankfurt, Germany (Summer 2013)
 ★ *SUMR Reunion Conference honoring Frank Connolly*; University of Notre Dame, (Spring 2013)
 ★ *Joint Math Meetings*; San Diego (Winter 2013)
 ★ *Syzygies Conference*; Cornell University (Fall 2012)
 ★ *Western Algebraic Geometry Seminar (WAGS)*; Univ. Utah (Fall 2012)
 ★ *MSRI Commutative Algebra Year*; Berkeley, CA (2012-2013)
 ★ *Macaulay2 Workshop*; Wake Forest Univ. (Summer 2012)
 ★ *MRC - Math Research Communities*; Geometry and Representation Theory Related to Geometric Complexity and Other Variants of P v. NP. Snowbird, Utah. (Summer 2012)
 ★ *Pan-American Advanced Studies Institute 2012*; Commutative Algebra, Algebraic Geometry, Representation Theory, and Physics; Guanajuato, Mexico (Summer 2012)

Western Algebraic Geometry Seminar (WAGS); Univ. Washington (Spring 2012)
AMS Section Meeting; Lawrence, KS (Spring 2012)
 ★ *Western Algebraic Geometry Seminar (WAGS)*; Fort Collins, CO (Fall 2011)
 ★ *MONICA*; Castro-Urdiales Spain, (Summer 2011)
Midwest Commutative Algebra and Geometry Conference; Purdue Univ. (Spring 2010)
Western Algebraic Geometry Seminar (WAGS); Stanford, CA (Spring 2011)
Local Rings; Trieste, Italy (Summer 2010)
MAGIC 2010; Notre Dame, IN (Spring 2010)
PASI: Commutative Algebra and its Connections to Geometry; Olinda, Brazil (Summer 2009)
 ★ *Algebraic Geometry Semester at MSRI*; Berkeley, CA (Spring 2009)
 ★ *Joint Math Meetings*; San Diego, CA (January 2008)
 ★ Undergraduate Work in Mathematics, Notre Dame, (September 2007)
 ★ *Joint Math Meetings*; New Orleans, LA (January, 2007)

Teaching Experience

Math 150 Calculus I (Spring 2024 San Diego)
 Math 360 Real Analysis (Fall 2023 San Diego)
 Math 395 Problem Solving Seminar (Fall 2023 San Diego)
 Independent Study (Brandon Eickert) Introduction to Algebraic Geometry (Spring 2023 San Diego)
 Math 250 Calculus (Spring 2023 San Diego)
 Math 395 Problem Solving Seminar (Spring 2023 San Diego)
 Math 320 Linear Algebra (Fall 2022 San Diego)
 Math 262 Discrete Math (Spring 2022 San Diego)
 Math 395 Problem Solving Seminar (Fall 2021 San Diego)
 Math 150 Calculus I (Fall 2021 San Diego)
 Independent Study / Thesis Research - Betti Numbers of Ideals (Valerie Gilbert, Spring 2021 San Diego)
 Independent Study - Linear Algebra and Data Science (Miranda Skinner, Spring 2021 San Diego)
 Math 262 Discrete Math (Spring 2021 San Diego)
 Math 320 Linear Algebra (Fall 2020 San Diego)
 Math 360 Real Analysis (Fall 2020 and Fall 2019 San Diego)
 Math 151 Calculus II (Spring 2020 San Diego)
 Independent Study - Elliptic Curves (J. Cardenas, Fall 2019 San Diego)
 Math 150 Calculus I (Fall/Spring 2019 and Fall 2018, San Diego)
 Independent Study - Introduction to Algebraic Geometry (Jonathan Cardenas, Spring 2019 San Diego)
 Math 300 Math Concepts for Elementary School Teachers II (Spring 2019 San Diego)
 Math 3210 Foundations of Real Analysis (Spring 2018 and Spring 2017 Utah)
 Math 4800 Introduction to Undergraduate Research (Representation Theory) (Fall 2017 Utah)
 Undergraduate Hyperbolic Geometry Seminar (Spring 2017 Utah)
 Math 4030 Foundations of Abstract Algebra (Fall 2016 Utah)
 Undergraduate Knot Theory Seminar (Fall 2016 Utah)
 Math 2270 Linear Algebra (Spring 2016 Utah)
 Freshman Group Theory Seminar (Spring 2016 Utah)
 Math 1260 AP Calculus II (Honors Freshman Calculus) (Fall 2015 Utah)
 Freshman Topology Seminar (Fall 2015 Utah)
 Math 3 Introduction to Number Theory (Fall 2014 Edinburgh)
 Math 53 Multivariable Calculus (Summer 2010 Berkeley)