

Max Lieblich

Contact Information

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Interests

- **Algebraic geometry:** projective geometry, moduli problems, algebraic stacks, derived categories, arithmetic geometry, connections with algebra and number theory, applications to computer vision
- **Education:** algorithms for (and development of) adaptive homework systems, use of modern web technologies in online course content creation and curation
- **Computer vision:** multiview geometry, automated pose detection, applications in healthcare and public health
- **Data:** affiliate faculty member of the UW eScience Institute, experience with geocoding administrative datasets, capturing and modeling human motions, familiarity with machine learning methods

Education

- **Massachusetts Institute of Technology**, PhD, 2004
Thesis title: *Moduli of Twisted Sheaves and Generalized Azumaya Algebras*
Advisor: A. J. de Jong
- **Harvard University**, AB *summa cum laude*, 2000
Thesis title: *Galois Representations Arising from p -Divisible Groups*
Thesis advisor: Brian Conrad

Employment

- **University of Washington** Craig McKibben & Sarah Merner Endowed Professor of Mathematics, 2019–
- **University of Washington** Professor, 2015–
- **University of Washington** Associate Professor, 2011–2015
- **University of Washington** Assistant Professor, 2009–2011
- **Princeton University** Assistant Professor, 2007–2009
- **Princeton University** Instructor, 2005–2007
- **Brown University** Visiting NSF Postdoctoral Fellow, 2004–2005
- **Clay Mathematics Institute** Liftoff Fellow, Summer 2004

Honors/Awards

- NSF Standard Grant, 2019–2022
- Simons Fellow in Mathematics, 2018–2019
- Fellow of the American Mathematical Society, elected 2017
- NSF Standard Grant, 2016–2019
- University of Washington CoMotion Innovation Fund Award, 2016–2017
- NSF CAREER Grant, 2011–2017
- Sloan Foundation Research Fellowship, 2010–2014
- Co-PI (with June Spector, UW Public Health) on a University of Washington Research Royalty Fund (RRF) grant for the use of novel algorithms in computer vision to aid in the construction of a tool for assessment of musculoskeletal risk in workers, 2014–2015. Worked with collaborators in the UW School of Public Health and the UW Computer Science and Engineering department. (The RRF is a highly-competitive internal UW grant that has a lower funding success rate than standard NSF grants.)
- Co-investigator on Washington State Department of Labor and Industries Medical Aid and Accident Fund grant to study the use of computer vision in musculoskeletal hazard assessment, 2012–2013
- National Science Foundation grant DMS-0758391, 2008–2011
- National Science Foundation Postdoctoral Fellowship, 2004–2007
- Sigma Xi, elected 2003
- National Science Foundation Graduate Fellowship, 2000–2003
- Phi Beta Kappa, elected 1999

Activities organized

- **SIAM AG 19 Minisymposium** on algebraic vision, Bern, Switzerland, July 2019
- **Western Algebraic Geometry Symposium** University of California, Berkeley, assisted with the organizing efforts, Spring 2019
- **American Institute of Mathematics** Workshop on algebraic vision, May 2016
- **Bootcamp for 2015 AMS Summer Institute in Mathematics**, co-organizer with Izzet Coskun, Angela Gibney, Tommaso de Fernex, Summer 2015
- **Seattle Conference for new PhDs in algebraic geometry**. Recruited Martin Olsson as co-organizer. This was a key component of my CAREER grant and brought together a diverse cohort of new PhDs in algebraic geometry with senior mentors, with the goal of building mutual understanding and a strong network bridging several subfields of algebraic geometry. Summer 2014.
- **Western Algebraic Geometry Symposium** University of Washington, co-organized with Kovács, Spring 2012
- **American Institute of Mathematics** Deformation theory, patching, quadratic forms, and the Brauer group, January 2011. Co-organized with Daniel Krashen.
- **Mathematical Sciences Research Institute** Workshop on deformation theory and moduli theory for graduate students in algebraic geometry, summer of 2007. Co-organized with Martin Olsson, Brian Osserman, and Ravi Vakil. Delivered a lecture series on sites, sheaves, and stacks; other lecture series given by Olsson and Osserman. The outcome is gradually being turned into a book.

Students

University of Washington

- Nathan Grigg (PhD 2013, now at Google)

- Matthew Ward (PhD 2014, now a writer)
- Pál Zsámbocki (PhD 2015, currently at the Rényi Institute, Hungary)
- William Casper (PhD 2017, postdoc at Louisiana State University)
- Siddharth Mathur (PhD 2018, postdoc at University of Arizona)
- Daniel Bragg (PhD 2018, postdoc at UC Berkeley)
- Andrew Ohana (Master's 2018, joint with William Stein)
- Gabriel Dorfman-Hopkins (PhD 2019, postdoc at ICERM and then UC Berkeley)
- Lucas van Meter (PhD 2019, teaching position at Lewis and Clark)
- Alex Voet (PhD expected 2020)

Princeton

- Atoshi Chowdhury (undergraduate thesis, 2006–2007)
- Robert Krone (undergraduate thesis 2007–2008)
- Cary Malkiewich (co-supervised undergraduate thesis with Rahul Pandharipande, 2009)

Mathematics Publications

1. *Moduli of Azumaya algebras*, **Oberwolfach Reports**, Vol. 1, Issue 3 (2004)
2. *Groupoids and quotients in algebraic geometry*, Snowbird lectures in algebraic geometry, **Contemporary Mathematics** 388 (2005), 119–136
3. (with Charles Cadman, Izzet Coskun, Kelly Jabbusch, Michael Joyce, Sándor Kovács, Fumitoshi Sato, Matt Szczesny, and Jing Zhang) *A first glimpse at the minimal model program*, Snowbird lectures in algebraic geometry, **Contemporary Mathematics** 388 (2005), 17–42
4. *Moduli of complexes on a proper morphism*, **Journal of Algebraic Geometry** 15 (2006), 175–206
5. *Remarks on the stack of coherent algebras*, **International Mathematics Research Notices**, vol. 2006, Article ID 75273.
6. *Moduli of twisted sheaves*, **Duke Mathematical Journal**, Volume 138, Number 1 (2007), 23–118.
7. *Twisted sheaves and the period-index problem*, **Compositio Mathematica**, Vol. 144 Part 1 (2008) 1–31
8. (with Daniel Krashen) *Index reduction for Brauer classes via stable sheaves*, with an appendix by Bhargav Bhatt, **International Mathematics Research Notices** (2008) Vol. 2008, article ID rnn010
9. (with Brian Osserman) *Functorial reconstruction theorems for stacks*, **Journal of Algebra** 322 (2009), no. 10, 3499–3541
10. *Compactified moduli of projective bundles*, **Algebra & Number Theory**, Vol. 3 (2009), No. 6, 653–695
11. *Deformation theory and rational points on rationally connected varieties*, in the book **Quadratic forms, linear algebraic groups, and cohomology**, Springer, 2010
12. (with Martin Olsson) *Generators and relations for the étale fundamental group*, **Pure and Applied Math Quarterly**, special issue in honor of John Tate, Vol 6 No 1, 209–243, 2010
13. *Moduli of twisted orbifold sheaves*, **Advances in Mathematics** (2011) Vol. 226, Issue 5, 4145–4182
14. *Arithmetic aspects of moduli spaces of vector bundles*, in *Grassmannians, moduli spaces and vector bundles*, 95–120, **Clay Mathematics Proceedings**, 14, American Mathematical Society, Providence, RI, 2011
15. (with Sándor Kovács) *Boundedness of families of canonically polarized manifolds: A higher dimensional analogue of Shafarevich's conjecture*, **Annals of Mathematics** (2011), Volume 173(1), 585–617.
16. *Period and index in the Brauer group of an arithmetic surface*, with an appendix by Daniel Krashen, **Journal für die Reine und Angewandte Mathematik (Crelle's Journal)** 659 (2011), 1–41.
17. (with Brian Conrad and Martin Olsson) *Nagata compactification for algebraic spaces*, **Journal of the Institute of Mathematics of Jussieu** 11 (2012), no. 4, 747–814

18. *Openness of tilted hearts*, appendix to *Bridgeland-Stable Moduli Spaces for K -Trivial Surfaces*, by D. Arcara and A. Bertram, **Journal of the European Mathematical Society (JEMS)** 15 (2013), no. 1, 1–38.
19. (with Davesh Maulik and Andrew Snowden) *Finiteness of $K3$ surfaces and the Tate conjecture*, **Annales Scientifiques de l'École Normale Supérieure** (4) 47 (2014), no. 2, 285–308
20. (with Parimala and Suresh) *Colliot-Thélène's conjecture and finiteness of u -invariants*, **Mathematische Annalen** 360 (2014), no. 1–2, 1–22
21. (with Martin Olsson) *Fourier-Mukai partners of $K3$ surfaces in positive characteristic*, **Annales Scientifiques de l'École Normale Supérieure** (4) 8 (2015), no. 5, 1001–1033
22. *The period-index problem for fields of transcendence degree 2*, **Annals of Mathematics** (2) 182 (2015), no. 2, 391–427
23. (with Rajesh Kulkarni) *BLT Azumaya algebras and moduli of maximal orders*, to appear in **Mathematische Annalen**
24. (with Davesh Maulik) *A note on the cone conjecture for $K3$ surfaces in positive characteristic*, **Mathematical Research Letters** (2019)
25. *On the ubiquity of twisted sheaves*, in *Birational geometry, rational curves, and arithmetic*, In: Bogomolov F., Hassett B., Tschinkel Y. (eds) **Birational Geometry, Rational Curves, and Arithmetic**. Simons Symposia. Springer, Cham
26. *Rational curves in the moduli space of supersingular $K3$ surfaces*, preprint
27. (with Dan Bragg) *Twistor spaces for supersingular $K3$ surfaces*, submitted
28. (with Martin Olsson) *A stronger derived Torelli theorem for $K3$ surfaces*, In: Bogomolov F., Hassett B., Tschinkel Y. (eds) **Geometry Over Nonclosed Fields** Simons Symposia. Springer, Cham
29. *Moduli of sheaves: a modern primer*, **Proceedings of Symposia in Pure Mathematics**, Volume 97.2, 2018 (the proceedings of the 2015 Utah AMS Summer Institute on Algebraic Geometry)
30. (with Lucas van Meter) *Two Hilbert schemes in computer vision*, to appear in **SIAM Journal on Applied Algebra and Geometry**
31. (with Benjamin Antieau, Asher Auel, Colin Ingalls, Daniel Krashen) *Period-index bounds for arithmetic threefolds*, **Inventiones Mathematicae** (2019)
32. (with Brian Osserman) *Descent of moduli spaces and limit linear series* **manuscripta mathematica** (2018)
33. (with Bianca Viray and Lucas Van Meter) *The essential variety revisited*, in preparation (re-proves and extends foundational results in computer vision due to Demazure and recent work of Kileel–Fløystad–Ottaviani)
34. (with Bastian Haase and Daniel Krashen) *A Tannakian approach to patching*, in preparation
35. (with Katrina Honigs and Sofia Tirabassi) *Fourier-Mukai partners of Enriques and bielliptic surfaces in positive characteristic*, to appear in **Mathematics Research Letters**
36. (with Daniel Krashen) *The Clifford algebra of a finite morphism*, submitted
37. (with Wei Ho) *Splitting Brauer classes using the universal Albanese*, submitted
38. (with János Kollar, Martin Olsson, and Will Sawin) *A reconstruction theorem for varieties*, in preparation
39. (with Martin Olsson) *A conjecture on derived categories*, in preparation
40. (with Daniel Bragg) *Perfect points on genus one curves and consequences for supersingular $K3$ surfaces*, submitted
41. (with Brian Conrad) *Galois representations arising from p -divisible groups*, book in preparation
42. (with Martin Olsson, Brian Osserman, and Ravi Vakil) *Deformation theory in algebraic geometry*, book in preparation

Other Publications

1. (with June Spector, Kevin McQuade, Stephen Bao) *Development and evaluation of the accuracy and feasibility of a computer vision/machine learning-based musculoskeletal hazard assessment and feedback tool*, abstract **PREMUS 2013** (Pusan, Korea)
2. *Automation of workplace lifting hazard assessment for musculoskeletal injury prevention*. Spector JT, Liebllich M, Bao S, McQuade K, Hughes M. **Annals of Occupational and Environmental Medicine** 2014 Jun 24; 26:15. doi: 10.1186/2052-4374-26-15, PMID: 24987523 [PubMed]
3. *Kinect Calculation of Lifting-Related Back Injury Risk*. Max Liebllich, June Spector, Kevin McQuade, Margaret Hughes, Stephen Bao. **36th Annual IEEE EMBS Conference**, late-breaking papers. Delivered as a poster in August 2014.
4. *Letter regarding 'Comparison between low-cost marker-less and high-end marker-based motion capture systems for the computer-aided assessment of working ergonomics' by Patrizi et al and research reproducibility*. Max Liebllich and June Spector. **Ergonomics**, 2016
5. *A case-crossover study of heat exposure and injury risk in agricultural workers in Washington State, USA*. June T. Spector, MD, MPH; David K. Bonauto, MD, MPH; Lianne Sheppard, PhD; Tania Busch-Isaksen, PhD; Miriam Calkins, MS; Darrin Adams, BS; Max Liebllich, PhD; Richard Fenske, PhD. **PLoS One**. 2016 Oct 7;11(10):e0164498. (My main contribution was geocoding a large messy dataset drawn from an administrative database of injury records.)
6. *Challenges in the application of computer vision techniques to ergonomics in manufacturing settings*, abstract **HFES 2016**
7. *A case-crossover study of heat exposure and injury risk in Washington State outdoor construction workers* by Miriam Calkins, David Bonauto, Anjum Hajat, Max Liebllich, Noah Seixas, Lianne Sheppard, June Spector; to appear in **Scandinavian Journal of Work, Environment & Health**

Software

1. Python code for smoothing, synchronizing, and resampling human joint location data collected from several systems simultaneously, building machine learning models for correcting the NIOSH Lifting Equation for Kinect skeleton model. (<https://github.com/maxliebllich/lifting-equation-kinect>)
2. R wrapper for Liljegren's C code computing the wet bulb globe temperature from meteorological data. (<https://github.com/mdljts/wbgt>)

Teaching

University of Washington

- Graduate course on algebraic geometry (varieties, schemes, sheaves, cohomology, etc.)
- Graduate course on algebraic vision (the algebraic geometry of computer vision)
- Graduate courses on deformation theory, Brauer groups, moduli of sheaves, commutative algebra and sheaves, ample divisors, K3 surfaces
- Yearly reading courses with numerous graduate students
- Extensive calculus teaching, including the creation of a website with 3D demos for third-quarter calculus
- SIMUW, the University of Washington summer program for mathematically talented high school students: gave guest lecture August 2009, taught full courses July 2010, July 2011, July 2012, July 2013, July 2014. Associate director for diversity starting 2011. Ran Facebook advertising campaigns in 2012 and 2013. Made contact with community groups as part of recruitment efforts. Started co-organizing a correspondence school/outreach component with Julia Pevtsova in 2013 in order to target students who may not have the background necessary for the traditional program.

Princeton University

- Undergraduate: Analysis, linear algebra, topics in algebra, introductory number theory
- Graduate: course on Galois categories

Massachusetts Institute of Technology

- Teaching assistant for calculus of one variable (18.01A) and calculus of multiple variables (18.02A), Fall 2003. Taught recitations and held two office hours per week, met with students by appointment.

Harvard University

- Course assistant for linear algebra (Math 121), Fall 1999. Taught a discussion section and graded homework. Met with students outside of section by appointment. Worked extensively with a blind student for two to three hours each week.

Ross Young Scholars Program

- Counselor, summer 1998. Guided three students through a system of problem sets designed by Arnold Ross to teach elementary number theory as well as foster a strong sense of self-education. Gave a lecture on axiomatic projective geometry and Desarguanian planes.

Visits

- **MSRI** member, March–May 2019
- **University of California, Berkeley**, Winter and Spring 2019
- **Stanford University**, Winter and Spring 2019
- **Rice University**, Fall 2018
- **Newton Institute, Cambridge**, Visiting Fellow during program on Moduli Spaces, May–June 2011
- **MSRI**, Jumbo Semester in Algebraic Geometry, February and May 2009
- **Universität Münster**, visiting Christopher Deninger, March 26 – April 3, 2005

Invited Conference Appearances and Lecture Series

- **Oberwolfach** Arithmetic Algebraic Geometry, August 2020
- **University of Wisconsin, Madison** plenary speaker at Moduli Spaces, March 2020
- **Banff** Interactions between Brauer Groups, Derived Categories and Birational Geometry of Projective Varieties, November 2019
- **University of Michigan** Arithmetic & Algebraic Geometry, August 2019
- **Stefan International Mathematical Center, Warsaw** Derived Categories and Geometry in Positive Characteristic, June–July 2019
- **MSRI** Recent Progress in Moduli Theory, May 2019
- **CIRM Trento** The Arithmetic of Derived Categories, July 2018
- **University of California, Berkeley** invited lecture series on the Tate conjecture, April 2018
- **University of Michigan** Project mentor, stacks project workshop, July–August 2017
- **Bar Ilan University** Louis Rowen birthday conference, June 2017
- **Emory University**, ECHORaP 2017, May 2017
- **Banff**, New trends in arithmetic geometry and algebraic surfaces, May 2017
- **Banff** New Trends in Arithmetic and Geometry of Algebraic Surfaces, March 2017
- **Banff**, Bridges between noncommutative algebra and algebraic geometry, September 2016
- **Washington, D.C.** Invited speaker and panelist, special session on Computer Vision and Occupational Ergonomics, HFES 2016, September 2016
- **Oberwolfach**, Arithmetic Algebraic Geometry, August 2016

- **University of Texas, Austin TAGS**, April 2016
- **Lorentz Institute, Leiden Oort Birthday Conference**, November 2015
- **Emory University GAGS**, October 2015
- **Mainz Summer School on Algebraic Stacks**, August-September 2015
- **Salt Lake City, AMS Summer Institute in Algebraic Geometry** (the “conference of the decade”), July 2015
- **Brazil ELGA II**, June 2015 (had to decline invitation due to family illness)
- **Nagoya K3, Enriques Surfaces and Related Topics**, November 2014
- **Berlin** invited series of lectures, September 2013
- **Baltimore Algebra and number theory day**, May 2013
- **AIM Palo Alto, Brauer groups and obstruction problems**, March 2013
- **Lorentz Center Leiden University, Current trends in arithmetic geometry**, January 2013, invited lecture series
- **Capital Normal University of Beijing Rational and integral points**, September 2012
- **Oberwolfach, Arithmetic Algebraic Geometry**, August 2012
- **University of Zurich Cohomological methods in arithmetic geometry**, September 2012
- **Banff Algebraic stacks: progress and prospects**, March 2012
- **Caneel Bay Simons Symposium, Geometry over non-closed fields**, March 2012
- **Newton Institute, Cambridge Closing conference**, June 2011
- **Columbia University Moduli spaces and moduli stacks**, May 2011
- **Emory University Ramification in Algebra and Geometry at Emory**, May 2011
- **Newton Institute, Cambridge Spitalfields Day**, May 2011
- **Sapienza Università di Roma Workshop in Deformation Theory II**, invited four lecture series, August-September 2010
- **Oberwolfach, Moduli Spaces in Algebraic Geometry**, January 2010
- **University of Texas, Austin Texas Algebraic Geometry Seminar (TAGS)**, April 2010
- **RIMS, Kyoto Noncommutative algebraic geometry and related topics**, August 2009
- **Columbia University Spaces of curves and their interaction with diophantine problems**, June 2009
- **MSRI Closing week conference for the Jumbo Semester on Algebraic Geometry**, May 2009
- **Hyderabad, India Program on quadratic forms, linear algebraic groups, and Galois cohomology. Lecture series on the work of de Jong and Starr on Serre’s Conjecture II over function fields of surfaces**, December 29, 2008–January 5, 2009. (Could not attend due to family emergency; contributed lecture notes that were distributed to participants and will appear in upcoming volume.)
- **Vancouver AMS Section Meeting, Special session on “Singularities and moduli spaces,”** October 2008
- **Banff Interactions Between Noncommutative Algebra and Algebraic Geometry**, October 2008
- **Oberwolfach, Arithmetic Algebraic Geometry**, August 2008
- **Scuola Normale Superiore, Pisa Aspects of Moduli**, June 2008
- **CIRM, Luminy Arithmetic Geometry and Rational Points**, December 2007
- **Clay Math Institute Moduli spaces of rational curves**, November 2007
- **Universität Konstanz Workshop on central simple algebras**, August 2007. Gave a series of invited lectures at a workshop for graduate students and recent PhDs on de Jong’s period-index theorem and related results.
- **Fields Institute Stacks in geometry and topology**, May 2007.
- **Emory University Linear algebraic groups and cohomology**, May 2007
- **National Taiwan University Workshop on Higher Dimensional Algebraic Geometry**, March 2007
- **Miami University AMS Section Meeting, Special Session on “Noncommutative Algebraic Geometry,”** March 2007

- **MSRI** Cohomological Approaches to Rational Points, March 2006
- **San Antonio** AMS-MAA Joint Meeting, Special Session on Division Algebras, Galois Theory, Cohomology and Geometry, January 2006
- **Seattle** AMS Summer Research Institute, Algebraic geometry, August 2005
- **American Institute of Mathematics** Birational geometry and compact moduli spaces, December 2004
- **Mathematisches Forschungsinstitut Oberwolfach** Arithmetic Algebraic Geometry, August 2004
- **Snowbird, Utah** Algebraic Geometry: Presentations by Young Researchers, July 2004

Other conferences

- **Washington, DC** Human Factors & Ergonomics Society, panel discussion on Computer Vision and Occupational Ergonomics, September 2016
- **Chicago** IEEE Engineering in Medicine and Biology Society (EMBC), August 2014, presented a poster about automated computation of the NIOSH Lifting Equation

Seminar and Colloquium Lectures

Dozens of invited seminar and colloquium lectures, at places including Bonn, Columbia, Duke, Stanford, Princeton, Northwestern, Rice, University of Pennsylvania, Boston College, MIT, Berkeley, University of British Columbia, University of Georgia, University of North Carolina, and others. List available upon request.

Service

- Member of AMS Mathematics Research Communities Advisory Board, 2019–
- Member of Enrollment Management Advisory Council, University of Washington 2018–2019
- Co-chair of Curricular and Co-Curricular Offerings and Development Workgroup, University of Washington 2018
- Faculty Advisory Workgroup, UW Faculty 2050 Initiative, 2017–2018
- Member of Senate Chair Thaisa Way's cabinet, 2017–2018
- UW Provost Search Committee, 2017
- UW Leadership Excellence Project, Cohort 2, 2016–2018
- UW Faculty Senate Executive Committee, 2016–2018
- UW Faculty Senate, 2015–2018
- AAUP Executive Board, 2015–2018
- Numerous departmental committees, including computing (two years), appointments (four years), planning (two years), personnel (one year), colloquium (one year), 2009–
- Associate Director of SIMUW, Fall 2012–
- Lectured at University of Washington Math Day 2010, Math Day 2012, gave plenary lecture at Math Day 2014
- Co-organizer of University of Washington Algebra and Algebraic Geometry Seminar, 2009–
- Co-organized (with Samuel Grushevsky) the Princeton Algebraic Geometry Seminar, 2006–2009. Served on the graduate admissions committee, 2009.
- Maintained webpage for geometry seminars and co-organized (with Dan Abramovich) the Brown University Algebraic Geometry seminar, 2004–2005.
- Organized the MIT Baby Algebraic Geometry Seminar, 2001–2002.
- Refereed or rendered initial opinions on papers for journals such as *Advances in Mathematics*, *Annales Scientifiques de l'École Normale Supérieure*, *Annals of Mathematics*, the *Bulletin de la Société Mathématique de France*, the *Duke Mathematical Journal*, *Ergonomics*, the *Journal of Algebraic Geometry*, the *Journal of the American Mathematical Society*, *Mathematische*

Annalen, Mathematische Zeitschrift, and the Transactions of the American Mathematical Society.

- Served on multiple NSF panels (years withheld)

Memberships

- Association for Women in Mathematics 2018–
- American Mathematical Society 1996–
- IEEE 2014–