Michael R. Klug

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Professional Positions

- **NSF Mathematics Postdoctoral Research Fellow**, University of Chicago (2022-Present)
- **L.E. Dickson Instructor**, University of Chicago (2021-Present)
- **Visiting Researcher**, Max Planck Institut für Mathematik – Bonn, Germany (Intermittent 2018-Present)
- **Graduate Student Researcher/Instructor**, U.C. Berkeley (2015-2020)
- **Data Analyst/Researcher**, Vermont Complex Systems Center (2014): Gathered/cleaned/analyzed large data sets resulting in a publication on the relationship between team dynamics and success.
- **Computational Researcher**, University of Vermont (2012-2013): Developed/implemented numerical techniques for computation of rings of modular forms resulting in publication.
- **Researcher**, Mann Lab, University of Vermont (2011-2012): Gathered/analyzed data on the dynamics of proteins in the blood coagulation cascade.

Education

- **University of California, Berkeley**, Berkeley, CA
  Ph.D. in Mathematics, 2015-2021
  Thesis: A relative version of Rochlin's theorem
  Thesis advisors: Robion Kirby and Peter Teichner
- **University of Vermont**, Burlington, VT
  B.S. (Honors) and M.S. in Mathematics (Accelerated Masters), 2013
  Major: Mathematics. Minors: Biology, Music
  Thesis (Mathematics): Computing rings of modular forms using power series expansions
  Thesis (Biochemistry): Dynamics of Factor XI activation

Awards

- NSF Mathematical Sciences Postdoctoral Research Fellowship ($150,000)
- L.E. Dickson Fellowship
- Salah Baouendi Fellowship
- Sang Kil Nam Scholarship for Excellence in Mathematics

Publications/Preprints

(1) *A group-theoretic framework for low-dimensional topology.* (w/ S. Blackwell, R. Kirby, V. Longo, B. Ruppik) (to appear in Algebraic and Geometric Topology) (2024).
(2) *Counting homomorphisms from surface groups to finite groups.* (to appear in Canadian Math. Bull.) (2024).
(3) *Properties of* $\mathrm{Pin}^{\pm}$*-structures on surfaces.* (w/ L. Stehouwer) Topology and its Applications, Vol. 339, (2023).
(4) *Concordance of spheres in 4-manifolds with an immersed dual sphere.* (w/ M. Miller) (submitted)(2022).
(5) *Kernels of splitting homomorphisms.* (submitted) (2022).
(6) *Representing smooth 4-manifolds as loops in the pants complex.* (w/ G. Islambouli) Mathematical Research Letters, Volume 28, Number 6, 1703–1738, (2021).
(7) *Unknotting numbers of 2-spheres in the 4-sphere.* (w/ J. Joseph, B. Ruppik, and H. Schwartz) Journal of Topology, Volume 14, Issue 4 1321-1350, (2021).
(8) *Concordance of surfaces in 4-manifolds and the Freedman-Quinn invariant.* (w/ M. Miller) Journal of Topology, Volume 14, Issue 2 (2021), 560-586.
(9) *Deep and shallow slice knots in 4-manifolds.* (w/ B. Ruppik) Proc. A.M.S. Ser. B 8 (2021), 204-218.
(10) *Building groups from restricted diagrams of groups.* (w/ N. Brody) (2021).
(11) *Comparison communication protocols.* (2021).
(12) *A relative version of Rochlin's theorem.* (submitted) (2020).
(13) *Functoriality of group trisections.*, PNAS Trisections of 4-Manifolds Issue October 23, 115 10875-10879 (2018).
(14) *Calculating the homology and the intersection form from a trisection diagram.* (w/ P. Feller, T. Schirmer, and D. Zemke), PNAS Trisections of 4-Manifolds Issue October 23, 115 10869-10874 (2018).
(15) *Understanding the group dynamics and success of teams.* (with J. Bagrow) Royal Soc. Open Sci., 3(4), (2016).
(16) *Numerical computation of three-point covers of the projective line.* (w/ M. Musty, S. Schiavone, and J. Voight), LMS Journal of Computational Math. 17, no. 1, 379-430 (2014).

Teaching

- **Instructor, U. Chicago:** Abstract Linear Algebra, Accelerated Real Analysis Sequence (year long).
- **Instructor, U.C. Berkeley:** Introduction to Research - Knot Theory, Linear Algebra/Differential Equations.

- **Graduate Student Instructor, U.C. Berkeley:** Linear Algebra/Differential Equations, Calculus, Multivariable Calculus, Discrete Mathematics.

Select Invited Talks

- *Free groups, surfaces groups, 3-manifolds, and 4-manifolds*, U.C. Davis, Topology Seminar, May 2023.
- *Free groups, surface groups, and low-dimensional topology*, Loyola, Topology Seminar, April 2023.
- *A group-theoretic approach to low-dimensional topology*, Stanford, Topology Seminar, November 2022.
- *The Stong invariant*, Banff Int. Math Research Station, 4.5-dimensional Topology Session, November 2022.
- *An invitation to low-dimensional topology*, University of Vermont, Colloquium, April 2022.
- $\mathbb{Z}/2$ *in low-dimensional topology*, Rice University, Topology Seminar, April 2022.
- $\mathbb{Z}/2$ *in low-dimensional topology*, IUPUI, Geometry/Groups/Dynamics Workshop, April 2022.
- *Concordance of surfaces*, JMM - Special Session on Knotted Surfaces, April 2022.
- *How not to study low-dimensional topology?* AMS Sectional Meeting, March 2022.
- *Outer automorphisms of* S_6 *and Pascal's Mysticum*, U. Chicago, Farb and Friends Seminar, November 2021.
- *Relative Rochlin's theorem*, McMaster University, Geometry and Topology Seminar, November 2021.
- *Relative Rochlin's theorem*, University of Georgia, Geometry and Topology Seminar, November 2021.
- *How not to study low-dimensional topology?*, U. Chicago, Geometry/Topology Seminar, November 2021.
- *Relative Rochlin's theorem*, U. Chicago, No Boundaries Seminar, November 2021.
- *An introduction to knotted surfaces*, U. Chicago, Dickson Day, September 2021.
- *Arf invariants in low-dimensional topology*, Max-Planck-Institut Topology Seminar, March 2021.
- *Arf invariants in low-dimensional topology*, AMS Spring Southeastern Virtual Sectional Meeting, March 2021.
- *Arf invariants in low-dimensional topology*, CVKV Seminar, March 2021.
- *Deep slice knots and Arf invariants*, Stanford Topology Seminar, Stanford, November 2020.
- *Concordance of surfaces in 4-manifolds*, U. Waterloo Geometry/Topology Seminar, Waterloo, February 2020.
- *Intersections of kernels of splitting homomorphisms*, AMS Special Session, Boston, April 2018.
- *Functoriality of group trisections*, 2017 American Institute for Mathematics, San Jose, March 2017.
- *Computing rings of modular forms*, Upstate New York Number Theory Conference, Binghamton, April 2013.

Referee Reports/Reviews/Quick Opinions for:

- Inventiones Mathematicae, Algebraic & Geometric Topology, Journal of Topology, Compositio Mathematica, Communications in Analysis and Geometry.

Conference/Seminar Organization

- Organizer for ongoing "No Boundaries" Seminar at University of Chicago.
- Organizer for the "Topology in Dimensions 3, 3.5, and 4" Conference at U.C. Berkeley.
- Organized/co-organized and presented in University of California, Berkeley student seminars including the Student Low-Dimensional Topology Seminar, 4-Manifold Seminar, and "Knot-Another-Seminar" Seminar.

Mentorship

- Chicago REU: Directed REU projects and taught courses on circle packings and graph theory.
- Directed Reading Program: Directed reading courses for students, culminating in presentations.
- Camp Euclid Mathematical Research Camp: Helped students to find/work on research problems.

Community Service

- **Julia Robinson Mathematics Festival, Chicago:** Judged projects/ran sessions for talented students.
- **Math Circle Instructor, Chicago:** Lectured/ran problem sessions for talented students.
- **Boy Scouts of America:** Eagle Scout.

Skills

- **Programming:** Experience in Python (Numpy, Pandas, Matplotlib), C, C++, Scheme, Magma, GAP.
- **Jazz Musician:** Perform on upright bass, occasionally piano and drums.
- **Languages:** English (native), German (advanced).