

Sarah Mousley Mackay

CONTACT INFORMATION Department of Mathematics mousley2@illinois.edu
University of Illinois at Urbana-Champaign <http://www.math.illinois.edu/~mousley2>

EDUCATION **University of Illinois at Urbana-Champaign, 3.98 GPA**
Ph.D. Candidate, Mathematics (2013-Present)
Expected graduation: May 2019
Advisor: Christopher J. Leininger, PhD
Utah State University, 3.99 GPA
B.S. in Mathematics with Actuarial Science Emphasis, May 2013

THESIS RESEARCH **Geometry, low-dimensional topology, group theory.** I research groups that arise naturally in low-dimensional topology and geometry, using tools from a variety of areas of mathematics including combinatorics and dynamics.

PUBLICATIONS AND PREPRINTS

- 6. Hierarchically hyperbolic groups are determined by their Morse boundaries**, arXiv:1801.04867, to appear in *Geom. Dedicata* (with J. Russell)
- 5. Exotic limit sets of Teichmüller geodesics in the HHS boundary** arXiv:1704.08645, to appear in *Groups Geom. Dyn.*
- 4. Non-existence of boundary maps for some hierarchically hyperbolic spaces** *Algebr. Geom. Topol.* 18 (2018), no. 1, 409–439
- 3. Spanning trees with leaf distance at least d** *Discrete Math.* 340 (2017), no. 6, 1412–1418. (with C. Erbes, T. Molla, and M. Santana)
- 2. k -primitivity of digraphs** *Linear Algebra Appl.* 449 (2014), 512–519. (with L. Beasley)
- 1. Estimates on the size of the cycle spectra of Hamiltonian graphs** *Discrete Math.* 313 (2013), no. 20, 2119–2123. (with P. Bahls and L. Kutler)

INTERNSHIPS **Naval Research Laboratory** *Washington, DC.* (May – July 2018)
Center for High Assurance Computer Systems
Mentor: Dr. Catherine Meadows, Formal Methods Section Head

- Used statistical tests to design network protocols to allow two parties to communicate covertly without being detected
- Implemented covert communication algorithms in Python software
- Proved that a detection theorem from image steganography holds for our covert communication scheme (Square Root Law)
- Prepared technical reports summarizing findings and describing future research directions
- Presented final results to the division

Sandia National Laboratory, *Albuquerque, NM* (May – August 2017)
Center for Computing Research
Mentor: Dr. Scott Mitchell, Principal Member of Technical Staff

- Studied the optimization of a mesh-quality function in order to produce meshes that yield good approximate solutions to partial differential equations
- Developed software in C++ to visualize the function’s landscape, giving insight into how to optimize

- Identified theoretical shortcomings in the optimization algorithm and proposed a new algorithm
- Wrote article for Sandia's Summer Proceedings and presented results

PROGRAMMING & COURSE WORK	Proficient in Python. Experience with C++ and Mathematica. Data Science, Numerical Methods, Math of Machine Learning and Artificial Intelligence
EXTERNAL TALKS	AMS special section on Interactions between geometry, group theory, and dynamics, Vanderbilt University, April 14–15, 2018 Canadian Mathematical Society winter meetings, special section on low dimensional topology and geometric group theory, Dec 2017 Virginia Topology Conference 2017: Hyperbolic 3-manifolds and beyond, Nov. 10–12, 2017 AMS special section on geometric group theory, State University of New York at Buffalo, Sept. 16–17, 2017 Graduate Student Topology Geometry Conference, Michigan State, April 8, 2017 Columbia University, Geometric Topology Seminar, Feb 17, 2017 Canadian Mathematical Society winter meetings, special section on low dimension topology and geometric group theory, Dec 5, 2016 Women in Mathematics Program, Research Seminar, Institute for Advanced Study, May 2016 Forty-Forth Southeastern International Conference of Combinatorics, Graph Theory, and Computing, Boca Raton, FL, March 2013 MAA Rocky Mountain Section Conference, Denver, CO, April 2012. MAA Intermountain Section Conference, March 2012.
HONORS AND AWARDS	Lackner Mathematics Graduate Fellowship, University of Illinois Spring 2018 AMS Graduate Student Travel Grant Fall 2017 National Defense Science and Engineering Graduate Fellowship (NDSEG) 2013–2016 Barry M. Goldwater Scholar 2012
TEACHING	Univ. of Illinois at Urbana-Champaign — Calculus I, II, III — <i>ranked excellent by students</i> <ul style="list-style-type: none"> • Led discussion sections with an emphasis on active learning • Designed evaluation rubrics and gave feedback on written work • Coordinate with a large staff to ensure course consistency across campus
LEADERSHIP ACTIVITIES	Illinois Geometry Lab Fall 2018 Mentor 9 undergraduates on research project to visualize parking patterns in large data set from San Francisco