

Neil R Hoffman

CONTACT INFORMATION	Dr. Howard Higholt Endowed Chair Associate Professor of Mathematics University of Minnesota - Duluth WWW: http://umn.edu/home/neilhoff E-mail: neilhoff@d.umn.edu
RESEARCH INTERESTS	My primary research interests are in low dimensional topology. More specifically, I consider problems involving triangulations of 3-manifolds, hyperbolic geometry, and knot theory. Currently, I am working on problems related to 3-manifold recognition and rigorous computation of 3-manifold invariants.
EMPLOYMENT	Associate Professor, University of Minnesota - Duluth, August 2023-present. Dr. Howard Higholt Endowed Chair, August 2023-present. Associate Professor, Oklahoma State University, July 2023-August 2023. Assistant Professor, Oklahoma State University, July 2016-July 2023. Research fellow, University of Melbourne, September 2013-June 2016. Guest Researcher, Max Planck Institute for Mathematics, September 2012-August 2013. Visiting Assistant Professor, Boston College, July 2011-June 2012.
INSTITUTES	ICERM-Fall Semester Program: Low-dimensional Topology, Geometry, and Dynamics, October, 2013.
EDUCATION	Ph.D. Mathematics, University of Texas, May 2011. Advisor: Alan Reid DISSERTATION: Properties of commensurability classes of hyperbolic knot complements B.A. Mathematics with Honors, Williams College, 2004. Thesis Advisor: Frank Morgan Budapest Semesters in Mathematics , Fall 2002.
CONFERENCES ORGANIZED	2022 Sage Days Dultuh together with K. Petersen 2021 Redbud virtual geometry/topology conference <i>together with H. Segerman</i> . https://math.okstate.edu/conferences/redbud/2021/ 2019 Redbud geometry/topology conference <i>together with R. Haraway</i> . https://math.okstate.edu/conferences/redbud/2019/ 2018 Redbud geometry/topology conference, <i>together with A. Eisenberg, R. Haraway, and H. Segerman</i> secured funding from NSF, https://math.okstate.edu/conferences/redbud/2018/
AWARDS	OSU Student Veterans Organization - Faculty Member of the Year 2017.

AWARDED
GRANTS AND
PROPOSALS

@collaborateICERM, *PSL(2; F) Representations of Homology Spheres*, together with K. Petersen, E. Samperton. (July 11-15, 2022).

2022 Sage Days Dultuh together with K. Petersen two funding awards \$25,000.00 (NSF to PI Petersen) \$20,000.00 (GEAR to Hoffman).

Distinguished Women in Mathematics Colloquium Series together with B. Tobin. Location: Stillwater, OK, President’s Fellows Campus Funding, \$14,488.00. (running in 2021-2022 academic year, finishing up in the 2022-2023 academic year)

AIM SQuaRE, *Which hyperbolic knot complements have hidden symmetries?* together with Eric Chesebro, Michelle Chu, Jason DeBlois, Priyadip Mondal, and Genevieve Walsh. October 2019-present. (on hold due to COVID will resume in 2022.)

Algorithmic recognition of 3-manifolds and tangles, Location: Stillwater, OK, Simons Foundation, \$42,000. 9/2017-present.

PUBLICATIONS All publications below have appeared or are to appear in peer-reviewed journals. In keeping with the standard practice in mathematics, all authors are listed alphabetically by last name.

Futer, David, Hamilton, Emily and Hoffman, Neil R. “Infinitely many virtual geometric triangulations”. arXiv:2102.12524. To appear Journal of Topology.

Baker, Kenneth L., Hoffman, Neil R, and Licata, Joan E. “Jointly primitive knots and surgeries between lens spaces.” arXiv:1904.03268. To appear in Communications in Analysis and Geometry.

Chesebro, Eric, DeBlois, Jason, Hoffman, Neil R, Millichap, Christian, Mondal, Priyadip and Worden, William “Dehn surgery and hyperbolic knot complements without hidden symmetries.” International Mathematics Research Notices, 2022.

Hoffman, Neil R, “Cusp types of quotients of hyperbolic knot complements.” Proceedings of the American Mathematical Society, Series B. 9 (2022), 336–350

Baker, Ken and Hoffman, Neil R, “Exceptional surgeries in 3-manifolds.” Proceedings of the American Mathematical Society, Series B. 9 (2022), 351–357.

Hoffman, Neil R, Millichap, Christian and Worden, William “Symmetries and hidden symmetries of (ϵ, d_L) -twisted knot complements.” Algebraic & Geometric Topology 22 (2022), 601–656.

Hoffman, Neil, and Nathan Sunukjian. “Null-homologous exotic surfaces in 4-manifolds” Algebraic & Geometric Topology 20 (2020), 2677—2685.

Baker, Kenneth L. appendix by Baker, Kenneth L. and Hoffman, Neil R. *The Poincaré homology sphere, lens space surgeries, and some knots with tunnel number two*. Pacific Journal of Mathematics, Vol. 305 (2020), No. 1, 1–27.

Hoffman, Neil R., and Jessica S. Purcell. “Geometry of planar surfaces and exceptional fillings.” Bulletin of the London Mathematical Society 49(2) (2017): 185-201

Garoufalidis, Stavros, Craig D. Hodgson, Neil R. Hoffman, and J. Hyam Rubinstein, “The 3D-index and normal surfaces.” Illinois Journal of Mathematics 60(1) (2016): 289-352.

Hoffman, Neil, Kazuhiro Ichihara, Masahide Kashiwagi, Hidetoshi Masai, Shin’ichi Oishi, and Akitoshi Takayasu. “Verified computations for hyperbolic 3-manifolds.” Experimental Mathematics 25(1) (2016): 66-78.

Dunfield, Nathan M., Neil R. Hoffman, and Joan E. Licata. “Asymmetric hyperbolic L -spaces, Heegaard genus, and Dehn filling.” *Mathematical Research Letters* 22(6) (2015): 1679 -1698.

Hoffman, Neil R., and Genevieve S. Walsh, “The big Dehn surgery graph and the link of S^3 .” *Proceedings of the American Mathematical Society, Series B* 2 (open access), no. 2 (2015): 17-34, <http://www.ams.org/journals/bproc/2015-02-02/S2330-1511-2015-00020-7/>.

Hoffman, Neil R. “Small knot complements, exceptional surgeries and hidden symmetries.” *Algebraic & Geometric Topology* 14, no. 6 (2015): 3227-3258.

Baker, Kenneth L., Brandy Guntel-Doleshal, and Neil Hoffman. “On manifolds with multiple lens space fillings.” *Boletín de la Sociedad Matemática Mexicana* 20, no. 2, (2014): 405-447.

Hoffman, Neil R. “On knot complements that decompose into regular ideal dodecahedra.” *Geometriae Dedicata* 173, no. 1 (2014): 299-308.

Hoffman, Neil. “Commensurability classes containing three knot complements.” *Algebraic & Geometric Topology* 10, no. 2 (2010): 663-677.

PREPRINTS

Haraway, Robert C. and Hoffman, Neil R, “On the complexity of cusped non-hyperbolicity.” arXiv:1907.01675, submitted.

Hoffman, Neil R. and Petersen, Kathleen L. “Small $PSL(2, \mathbb{F})$ representations of Seifert fiber space groups” arXiv:2209.05478, submitted.

IN PREPARATION

Hoffman, Neil R. and Worden, William. “Arithmetic fully augmented links.”

Haraway, Robert C., Hoffman, Neil R., Schleimer, Saul and Sedgwick, Eric. “Link diagram recovery in exponential time.”

Hoffman, Neil R. and Manning, Jason. “Constructing asymmetric knots in a generic 3-manifold.”

Hoffman, Neil R, Petersen, Kathleen, and Samperton, Eric. “ $PSL(2, \mathbb{F})$ representations of homology spheres.”

Fili, Paul, Hoffman, Neil R, and Petersen, Kathleen. “Bounding the minimal factor of families of Lacunary polynomials.”

SUPERVISED RESEARCH

Birch Bryant, “Fibers as normal and spun-normal surfaces surfaces in link manifolds.” PhD May 2023.

Joshua Ross, “Compression of orientable 3-manifold triangulations and Pachner Paths.” Oklahoma State Masters thesis, 2022.

Joshua Ross, “Angle Structures and Normal Surfaces in Closed Pseudo-Manifolds”. Oklahoma State Honors Thesis, 2020.

Tucker Feix, “Two Methods for Triangulating Hyperbolic Punctured Spheres”. Oklahoma State Honors Thesis, 2018.

(together with Craig Hodgson) James Cliff. “Scissor congruence for manifolds in the cusped and closed censuses of hyperbolic 3-manifolds”, University of Melbourne, 2016.

(together with Craig Hodgson) Dadd, Blake, and Aochen Duan. ”Constructing infinitely many geometric triangulations of the figure eight knot complement.” Proceedings of the American Mathematical Society 144.10 (2016): 4545-4555. (Research preformed University of Melbourne, 2014.)

(together with Craig Hodgson) Emma Kong and Curtis Mustgrave-Evans. “Maximal equal area cusp packings of punctured spheres”, University of Melbourne, 2015.

CURRENT SUPERVISION

(with Henry Segerman) Eric Towers, “Censuses of knots and links in lens spaces.” Expected PhD graduation Fall 2023.

UNDERGRADUATE RESEARCH

Corneli, Joseph, Neil Hoffman, Paul Holt, George Lee, Nicholas Leger, Stephen Moseley, and Eric Schoenfeld. ”Double bubbles in S^3 and H^3 .” Journal of Geometric Analysis 17, no. 2 (2007): 189-212.

SELECTED INVITED TALKS

(* indicates talks canceled in 2020 because of COVID)

Distinguishing Seifert fiber spaces from lens spaces, Geometry, Arithmetic, and Groups (in honor of Alan Reid’s 60th birthday), Austin, TX June 2022.

Constructing asymmetric knots in a generic 3-manifold. AMS Sectional Meeting, Tufts, March 2022.

Arithmetic Fully Augmented Links, Redbud Topology Seminar, February 2022.

Bounds on crossing number via knot diagram recovery, UC-Davis, May 2021, Australian Geometric Topology Webinar, May 2021, AMS Central Sectional Meeting, October, 2021. Redbud Topology Seminar, October 2021.

Infinitely many virtual geometric triangulations, AMS Western Sectional Meeting, May 2021.

Cusp types of quotients of hyperbolic knot complements, Joint Math Meetings, January, 2021

Conjectures related to knot complement commensurability, UQAM (virtual), December 2020.

High crossing knot complements with few tetrahedra, Geometry and Topology Online, Warwick Mathematics Institute and International Centre for Mathematical Sciences (virtual), May 2020.

* High crossing knots with small complexity complements, Eastern Illinois Integrated Conference in Geometry, Dynamics, and Topology, <https://ux1.eiu.edu/gdt/2020.html>

* Cusp types of quotients of hyperbolic knot complements, AMS Sectional Meeting Boston, March 2020.

Symmetries and Hidden Symmetries of (ϵ, d_L) -Twisted Knot Complements. AMS Section Meeting, Gainesville, FL, November, 2019.

On the complexity of cusped non-hyperbolicity, Rice University, October 2019, Florida State University (Colloquium), November 2019.

Symmetries and Hidden Symmetries of knots obtained by high parameter surgeries on Fully Augmented links, University of Arkansas, April 2019.

The 3D index as a sum over surfaces, RIMS (Kyoto), June, 2018.

Unifying unexpected lens space surgeries, University of Arkansas, November 2017, Columbia, April 2018.

Determining co-hyperbolicity of 3-manifolds, University of Oklahoma, October 2017.

Geometry of planar surfaces and exceptional fillings, University of Pittsburgh, October 2016.

Symmetries of knots in the Poincare homology sphere with cyclic fillings, Monash University March 2016.

Commensurability classes of knot complements, University of Illinois-Chicago, University of Illinois, December 2015

Asymmetric knots with two cyclic surgeries, Knots in Washington, December 2015

Geometry of planar surfaces and exceptional fillings, Flinders University, September 2015

Verified canonical triangulations, University of Sydney, November 2014

Verified computations for hyperbolic 3-manifolds, Australia National University, May 2014

(with Kimihiko Motegi) A talk in 3 acts: Verified computations, L-space surgeries, and exceptional fillings, Shonan Conference April 2014

Software presentation: HIKMOT, ICERM, October 2013

Verified computations for hyperbolic 3-manifolds, Maryland, Miami, Wisconsin, Williams, Texas, October 2013

The big Dehn surgery graph and the link of S^3 , AusMS Sydney, 2013

Knot complements and commensurability, Tokyo Institute of Technology, May 2013

3-manifolds, group weight, and Dehn surgeries, Cube complexes and 3-manifolds, University of Illinois at Chicago, May 2013

Verified computations for hyperbolic 3-manifolds, Geometric topology in Cortona, Interactions of quantum topology and hyperbolic geometry, A conference in honor of Riccardo Benedetti for his 60th birthday, June 2013

Generalized Berge knots, Low-dimensional Topology and Geometry in Toulouse, June 2013

LOCAL TALKS

Triangle groups and small congruence certificates, (Two parts), Oklahoma State Number Theory Seminar, Fall 2021.

Bounds for arithmetic invariants of 3-manifolds, Oklahoma State Topology Seminar, Fall 2021.

Exceptional Surgeries in 3-manifolds, Spring 2021.

Three sphere recognition modulo GRH, Oklahoma State Topology Seminar, Fall 2019.

Knot complements covering orbifolds, Oklahoma State Topology Seminar, Fall 2018.

Asymmetric knot complements in arbitrary 3-manifolds, Oklahoma State Topology Seminar, Spring 2018.

Working seminar: SnapPy - software to deal with hyperbolic manifolds, Oklahoma State Topology Seminar, Spring 2018.

Working seminar: What is the Pachner graph? with Henry Segerman, Oklahoma State Topology Seminar, Fall 2017.

Infinite geometric triangulations of hyperbolic 3-manifolds, Oklahoma State Topology Seminar, Fall 2017.

Determining co-hyperbolicity of 3-manifolds, Oklahoma State Topology Seminar, Spring 2017.

Unifying exceptional surgeries, Oklahoma State Topology Seminar, Fall 2016

What is SnapPy, Oklahoma State Topology Seminar, January 2016

UNDERGRADUATE/GENERAL

AUDIENCE

TALKS

Northern Oklahoma Math Teachers' Circle (together with Melissa Mills), September 2022.

Northern Oklahoma Math Teachers' Circle (virtual), April 2020.

Tic-tac-toe is simple, isn't it? Oklahoma State Math Club, Fall 2019.

Stillwater High School Math Club, Spring 2019

Wallpaper Patterns, Oklahoma State Math Club, Spring 2017.

TEACHING

Spring 2023 - Calculus III (Oklahoma State)

Fall 2022 - Calculus III, Algebraic Number Theory (Oklahoma State)

Spring 2022 - Calculus III (Oklahoma State)

Fall 2021 - Calculus II, General Topology (Oklahoma State)

Spring 2021 - Calculus II (Oklahoma State)

Fall 2020 - Calculus II, General Topology (Oklahoma State)

Spring 2020 - Calculus II (Oklahoma State)

Fall 2019 - Calculus III (Oklahoma State)

Spring 2019 - Calculus III (Oklahoma State)

Spring 2019 - Math Structures (Oklahoma State)

Fall 2018 - Grad Seminar on Geometric orbifolds (Oklahoma State)

Fall 2018 - Math Structures (Oklahoma State)

Fall 2017 - Calculus I (Oklahoma State)
Spring 2017- Intro. to Topology (Oklahoma State)
Fall 2016 - Calculus I (Oklahoma State)

SERVICE

Co-advisor, Oklahoma State University Association for Women in Mathematics local chapter, Fall 2020-present.
Hiring Committee, Fall 2021-present.
Personnel Committee, Fall 2019-Spring 2020.
Doctoral Topology Curriculum Committee, Fall 2018-Fall 2019.
Voting Rules Committee, Spring 2019.
A. Giannopoulos, Masters report committee, Summer 2018.
Postdoctoral recruitment committee, Oklahoma State, Fall 2016- Spring 2018.
Assistant Director Vacation Scholars Program Summer 2016 University of Melbourne
Seminar Organizer: Knot Invariants 2015 University of Melbourne
Session organizer: AustMS/NZMS 2014 Special Session on Geometry and Topology (similar to an AMS special session)
Website manager - 2014/2015 Maths and Stats. Department Vacation Scholars Program. (Uni. Melbourne)
Participant, University of Melbourne Open Day 2014.
Director, Saturday Morning Math Group, University of Texas 2010.