

HAYLEY ANNE OLSON

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EDUCATION

University of Nebraska-Lincoln

Ph.D. in Mathematics

May 2022

MS in Mathematics

May 2019

Advisors: Drs. Mikil Foss and Petronela Radu

Thesis: Convergence of Steady-State Nonlocal Nonlinear Diffusion Operators in the Limit of the Vanishing Horizon

Gonzaga University

BS in Mathematics with Honors, *summa cum laude*

May 2017

Advisor: Dr. Allan Greer

Thesis: Who Broke Ohms Law? An Investigation of Why Experimental Results in a Simple Circuit Came Out Wrong

AWARDS

Don Miller Award for Outstanding Teaching by a Graduate Student

November 2020

Department of Mathematics, University of Nebraska - Lincoln

Lincoln, NE

- The Mathematics Department places a very high value on quality teaching, and since 1991 has honored outstanding teaching by a graduate teaching assistant each year with the Don Miller Award.

Carsrud Award

April 2017

Department of Mathematics, Gonzaga University

Spokane, WA

- An award given to a graduating senior mathematics major. The recipient of the Carsrud award is an outstanding mathematics student. In years when no such student exists, the award is not conferred.

MAA Award

April 2016

Department of Mathematics, Gonzaga University

Spokane, WA

- An award given to exceptional junior mathematics majors. Students are chosen for this award based upon ability, effort, and personification of the ideals of our discipline.

Underclassman Award

April 2014

Department of Mathematics, Gonzaga University

Spokane, WA

- An award given to the most promising freshman or sophomore in a mathematics class. Members of the department nominate students for this award. The nominees are invited to take a mathematics test at a specified time. The nominee with the highest exam score receives the award.

EMPLOYMENT

Postdoctoral Associate

September 2022-Present

Department of Mathematics, Carnegie Mellon University

Pittsburgh, PA

- Prepare and lead active learning lectures for University students.
- Coordinate with other lecturers to unify course material and improve student experience and success rates.

Graduate Teaching Assistant

August 2017-May 2022

Department of Mathematics, University of Nebraska - Lincoln

Lincoln, NE

- Prepare and lead active learning style courses for University students.
- Coordinate with other lecturers to unify course material and improve student experience and success rates.

Sandia Summer Student Intern - Math Research

June 2021-August 2021

Group 8754: Computational Modeling & Analysis, Sandia National Laboratories *Livermore, CA (Remote)*

- Research nonlocal vector calculus with Drs. Marta D'Elia and Mamikon Gulian.
- Funded by Sandia National Labs, facilitated by NSF Mathematical Sciences Graduate Internship Program.

Graduate Research Assistant

January 2021-May 2021

Department of Mathematics, University of Nebraska - Lincoln

Lincoln, NE

- Research nonlocal vector calculus with Drs. Marta D'Elia and Mamikon Gulian from Sandia National Labs and Drs. Mikil Foss and Petronela Radu at University of Nebraska, Lincoln.
- Funded by Sandia National Laboratories.

Sandia Summer Student Intern - Math Research

May 2020-August 2020

Group 1442: Computational Mathematics, Sandia National Laboratories *Albuquerque, NM (Remote)*

- Research nonlocal vector calculus with Drs. Marta D'Elia, Mamikon Gulian, and Michael Parks.
- Funded by the NSF Mathematical Sciences Graduate Internship Program.

Sandia Summer Student Intern - Math Research

June 2019-July 2019

Group 1442: Computational Mathematics, Sandia National Laboratories

Albuquerque, NM

- Research nonlocal vector calculus with Drs. Marta D'Elia, Mamikon Gulian, and Michael Parks.
- Funded by the NSF INTERN grant supplement and Sandia National Laboratories.

Gonzaga Math Tutoring Lab

January 2015-May 2017

Department of Mathematics, Gonzaga University

Spokane, WA

- Clearly communicated math topics to students struggling with University level work.
- Coordinated multiple students across different classes at the same time.

- Worked with Drs. Rolland Trapp and Corey Dunn at CSU, San Bernardino. Funded by the NSF.
- Produced original research in a subcategory of hyperbolic knot theory.

PUBLICATIONS

8. M. FOSS, H. OLSON, AND P. RADU, *Convergence of Steady-State Nonlocal Nonlinear Diffusion Systems in the Limit of the Vanishing Horizon*. Preprint (2022).
7. H. OLSON, M. D'ELIA, M. FOSS, M. GULIAN, AND P. RADU, *Comparison of Tempered and Truncated Fractional Models: A Machine Learning Approach*. Computer Science Research Institute Summer Proceedings 2021. Technical Report SAND2022-0653R, Sandia National Laboratories, 2021, 112-119.
6. M. D'ELIA, M. GULIAN, H. OLSON, AND G. KARNIADAKIS, *Towards a Unified Theory of Fractional and Nonlocal Vector Calculus*. Fractional Calculus and Applied Analysis. **24** (2021), no.5, 1301-1355.
5. S. BERES, V. COUFAL, K. KEARNEY, R. LATTANZI, AND H. OLSON. *Linking Numbers of Klein Links*. The College Mathematics Journal. **52** (2021), no.2, 106-114.
4. H. OLSON, M. D'ELIA, M. GULIAN. *The Tempered Fractional Laplacian As a Special Case of the Nonlocal Laplace Operator*. Computer Science Research Institute Summer Proceedings 2020. Technical Report SAND2020-12580R, Sandia National Laboratories, 2020, 111-126.
3. H. OLSON, M. D'ELIA, M. GULIAN. *Towards a Unified Nonlocal Vector Calculus*. Computer Science Research Institute Summer Proceedings 2019. Technical Report SAND2020-9969R, Sandia National Laboratories, 2020, 11-19.
2. J. HARNOIS, H. OLSON, R. TRAPP. *Hyperbolic tangle surgeries on augmented links*. Algebraic and Geometric Topology. **18** (2018), no.3, 1573-1602
1. S. BERES, V. COUFAL, K. HLAVACEK, K. KEARNEY, R. LATTANZI, H. OLSON, J. PEREIRA, AND B. STRUB. *A classification of Klein links as torus links*. Involve. **11** (2018), no.4, 609-624.

TEACHING EXPERIENCE

Associate Course Convener

As associate convener, I worked closely with the relevant faculty course convener to run weekly course meetings and generally support the instructors on a day-to-day basis.

- UNL Math 100A: Intermediate Algebra (Fall 2019, Spring 2020)

In this position I oversaw 10 sections of Math 100A and wrote coordinated exams for use by hundreds of

students. Additionally, in the Spring 2020 semester I introduced a new mastery-based grading scheme for the course.

- UNL Math 106: Calculus I (Fall 2020)

This position for Calculus focused on coordinating and supporting the 18 recitation leaders involved in the course. A majority of the recitation leaders had minimal prior teaching experience – being either undergraduate students or first year graduate students – so this position presented an opportunity to mentor new instructors.

Instructor of Record

As an instructor of record, I focused on leading an active-learning style classroom. I kept lectures concise and focused a majority of class time on supporting the students as they work through exercises generated intentionally to provide proper scaffolding to understand the course material.

- UNL Math 100A: Intermediate Algebra (Fall 2018, Spring 2019, Fall 2019, Spring 2020)
- UNL Math 106: Calculus I (Fall 2021)
- CMU Math 21 120: Integral and Differential Calculus (Fall 2022)
- CMU Math 21 268: Multidimensional Calculus (Fall 2022)

Teaching Assistant

- UNL Math 106/107R: Calculus I/II Recitation (Fall 2017, Spring 2018, Fall 2020, Fall 2021)

As a recitation leader in the two calculus courses, I met with my students to work through exercises and deepen their understanding of the lecture material.

- UNL Math 810T: Algebra for Algebra Teachers (Summer 2018)

In addition to supporting the students in exercises I also had the opportunity to teach a few of the lectures for this graduate-level course under the direction of the instructor of the course

SERVICE AND OUTREACH

Meet a Mathematician: Lessons for Classrooms

Spring 2022-Present

- The mission of Meet a Mathematician is to share stories of mathematicians from different backgrounds, especially from historically excluded groups, with the aim of introducing students to role models and fostering a sense of community.
- Together with a group of other mathematicians and K-12 teachers, we are working to develop lesson plans which utilize the videos from the website.
- We are also conducting a pilot study which aims to determine the impact of the videos on students' mathematical identities.

JMM SIAM Minisymposium Organizer

January 2022

- Co-organized the SIAM Minisymposium on Graduate Research in Industry and in National Laboratory Internships for the January 2022 Joint Math Meetings.

UNL Graduate Student Mentorship Program

Fall 2019, Fall 2020, Fall 2021

- Mentoring first year graduate students in the UNL Math Department in order to ease the transition into graduate life and prepare the student for success in the coming years.

UNL Math Day

November 2017, 2018, 2019, 2020, 2021

- Volunteered at an event to get high school students interested in studying mathematics at the university level.

UNL Graduate Student Seminar Internship Panelist

November 2020

- Participated in a panel discussing non-academic internship experiences for math graduate students.

Contium Mechanics Seminar Organizer

Spring 2020

- Co-organized the Continuum Mechanics Seminar at UNL.

UNL Math Graduate Student Advisory Board

September 2018-June 2020

- Worked as part of a team to coordinate events for the department to increase community between faculty, staff, graduate students, and undergraduate students.
- Acted as a conduit for communication between graduate students and the mathematics department

Nebraska Conference for Undergraduate Women in Mathematics

Fall 2017, 2018, 2019

- Volunteered at UNL's conference which promotes undergraduate women in mathematics to pursue graduate study in mathematics and to seek mathematical careers.

All Girls/All Math

Summer 2018

- Paid position acting as a mentor for female high school students interested in pursuing science and mathematics during a two-week summer camp.

Gonzaga Pi Mu Epsilon Executive Committee Member

September 2016-May 2017

- Organize meetings of the chapter and oversee induction of new members.

Gonzaga Math Tutoring Outreach Program

September 2015-May 2017

- Tutored K-12 students as part of Gonzaga University's partnerships with local K-12 institutions to provide free mathematics tutoring to students.

TALKS & PRESENTATIONS

WORKSHOPS:

1. *(Invited)* **Theoretical and Applied Aspects for Nonlocal Models**, 5-day workshop at Banff International Research Station (BIRS), July 2022.

AT CONFERENCES & EXTERNAL SEMINARS:

25. **Convergence of nonlinear nonlocal diffusion models in the limit of the vanishing horizon**, BIRS 22w5102 Theoretical and Applied Aspects for nonlocal Model, July 2022.
24. **Mathematical analysis for nonlocal nonlinear diffusion models** UNL PhD Thesis Defense, April 2022.
23. **Nonlocal Calculus: an Alternative to Classical Differential Operators**, Job Interview Research Presentations, January & February 2022.
22. **Tempered Fractional Models: Integration Into Nonlocal Vector Calculus and Comparison to a Computationally Cheaper Alternative**, Joint Math Meetings 2022, January 2022.
21. **Analyzing Nonlinearities in the Nonlocal Diffusion Model**, 17th Prairie Analysis Seminar, Kansas State University (Virtual), November 2021.
20. **Nonlinear Diffusion in the Nonlocal Calculus Framework: Convergence Results**, KUMUNU-ISU, University of Nebraska-Lincoln (Poster Session), October 2021.
19. *(Invited)* **Nonlinear Diffusion in the Nonlocal Setting**, AMS Fall Central Sectional Meeting, Creighton University (Virtual), October 2021.
18. **Investigating Nonlinearities in Nonlocal Calculus**, Midwest Women in Science Conference, University of Chicago (Virtual), September 2021.
17. *(Invited)* **Tempered Fractional Laplacian in the Nonlocal Framework**, U.S. National Congress on Computational Mathematics (Virtual), July 2021.
16. **Convergence of Nonlinear Nonlocal Operators to Classical Counterparts**, SIAM Annual Meeting (AN21) (Virtual Poster Session), July 2021.
15. *(Invited)* **Investigating Nonlinear Diffusion in the Nonlocal Vector Calculus Framework**, Pitt AWM Student Seminar Series, May 2021.
14. **Tempered and Truncated Fractional Operators - Exploring Reduction of Computational Costs**, Probability, Analysis, and Data Science Seminar, Iowa State University (Virtual), March 2021.

13. (*Invited*) **A Unified Theory of Fractional and Nonlocal Vector Calculus: Main Results and Implications**, SIAM Conference on Computational Science and Engineering (CSE21), Chicago, IL (Virtual), March 2021.
12. **Convergence of Nonlinear Nonlocal Operators to their Classical Counterparts**, Analysis Seminar, Kansas State University (Virtual), February 2021.
11. **Nonlinear Nonlocal Operators with Comparisons to Classical Nonlinear Diffusion**, Seminario Interuniversitario de Investigación en Ciencias Matemáticas (Virtual), February 2021.
10. **Convergence of Nonlinear Nonlocal Operators to Local Operators**, One Nonlocal World (Virtual Poster Session), January 2021.
9. **Poincaré Inequalities in a Nonlocal Vector Calculus**, Junior Analysis Seminar, Iowa State University, March 2020.
8. **Well-posedness of Systems with Weighted Nonlocal Vector Calculus Operators**, SIAM Central States Session, Iowa State University, October 2019.
7. **Sharpening the volume bound on a class of hyperbolic augmented links**, AMS Sectional Meeting, Washington State University, April 2017.
6. **Link Invariants on Klein Links**, Spokane Intercollegiate Research Conference, Gonzaga University, April 2017.
5. **Sharpening the volume bound on a class of hyperbolic augmented links**, Nebraska Conference for Undergraduate Women in Mathematics (Poster Session), University of Nebraska - Lincoln, February 2017.
4. **Nested Links: the links that act fully augmented**, CSUSB REU Presentation Session, California State University, San Bernardino, August 2016.
3. **Sharpening the volume bound on a class of hyperbolic augmented links**, CSUSB REU Poster Session, California State University, San Bernardino, August 2016.
2. **Klein links versus torus links**, Spokane Intercollegiate Research Conference, Whitworth University, April 2016.
1. **Klein links versus torus links**, Pacific Northwest joint MAA and NUMS Meeting, Oregon State University, April 2016.

FOR UNL SEMINARS:

9. **Is your math course racist?**, Teaching and DEI Excellence Seminar, November 2021.

8. **Exploration of a Doubly Nonlinear System with the Nonlocal Fractional p -Laplacian**, Continuum Mechanics Seminar. April 2021.
7. **Analysis of Tempered Fractional Operators**, Continuum Mechanics Seminar. October 2020.
6. **Towards Convergence of Nonlinear Nonlocal Operators**, Partial Differential Equations Seminar. October 2020.
5. **Nonlocal Vector Calculus**, Comprehensive Exam Presentation. November 2019.
4. **Nonlocal Operators and Weighted Calculus**, Continuum Mechanics Seminar. March 2019.
3. **Introduction to Global Attractors and the Kuratowski measure of non-compactness**, Partial Differential Equations Seminar. 2 talks. November 2018.
2. **Space Camp: Introduction to oft used vector spaces in differential equations**, Students in PDEs Seminar. October 2018.
1. **Comparison of local and nonlocal Laplacian operators**, Continuum Mechanics Seminar. October 2018.

TECHNICAL SKILLS

Proficient with \LaTeX , MATLAB, Python 3, Keras Tensorflow API, and PG (WeBWorK).

SOCIETIES AND MEMBERSHIPS

AMS American Mathematical Society

AWIS Association for Women in Science

AWM Association for Women in Mathematics

PME Pi Mu Epsilon, Washington Epsilon Chapter

SIAM Society for Industrial and Applied Mathematics